DOCUMENT RESUME

ED 063 499

VT 015 656

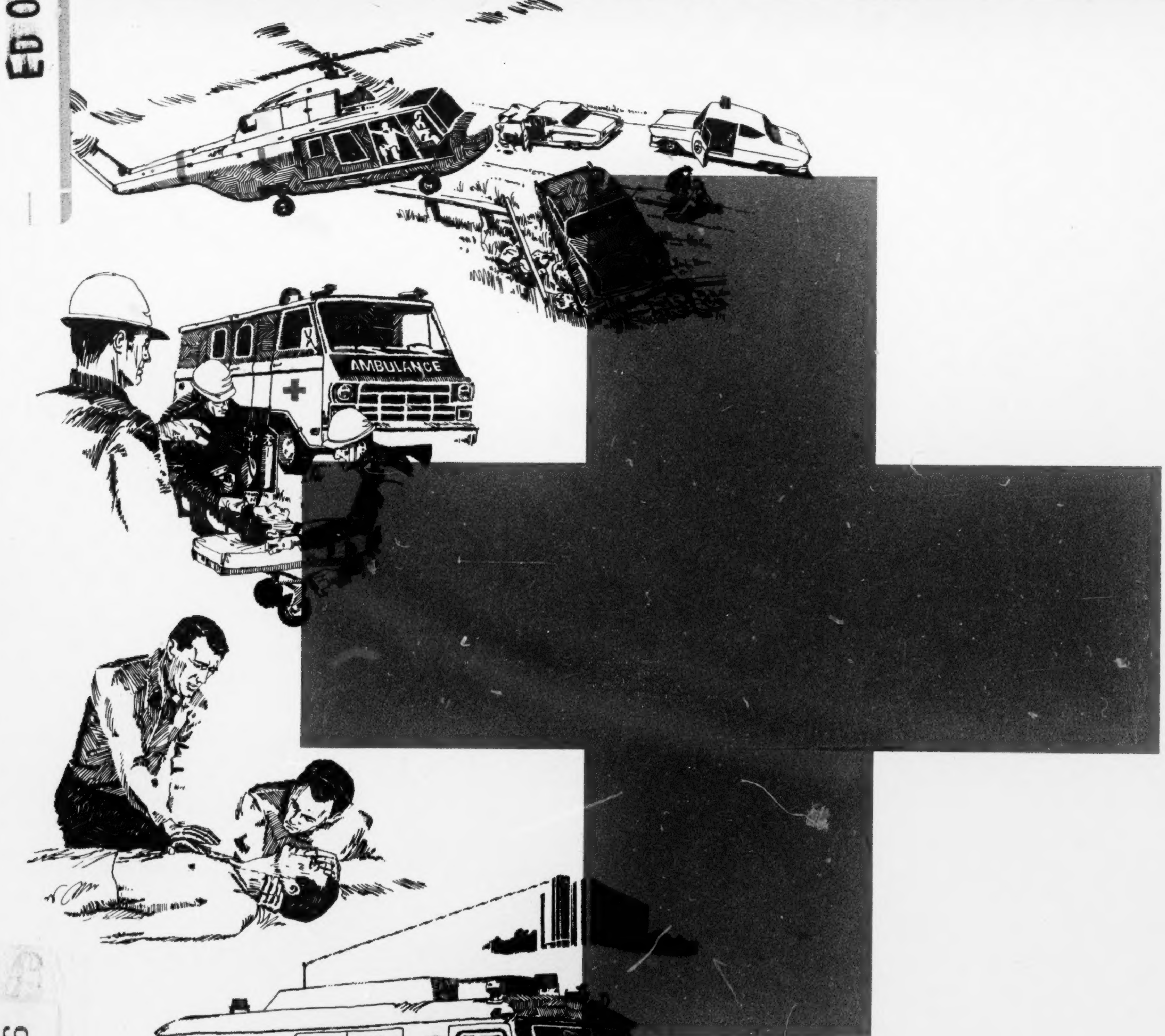
TITLE	Emergency Victim Care. A Textbook for Emergency Medical Personnel.
INSTITUTION	Ohio State Dept. of Education, Columbus. Trade and Industrial Education Service.
PUB DATE	71
NOTE	357p.
AVAILABLE FROM	Instructional Materials Laboratory, Trade and Industrial Education, The Ohio State University, 1885 Neil Avenue, Columbus, Ohio 43210 ($4.25)
EDRS PRICE	MF-$0.65 HC-$13.16
DESCRIPTORS	Adult Education; Bibliographies; Career Education; Drug Abuse; *Emergency Squad Personnel; Equipment; First Aid; Glossaries; *Health Occupations Education; Instructional Materials; Manuals; Medical Education; Paramedical Occupations; Rescue; Safety Education; *Study Guides; *Textbooks; Trade and Industrial Education

ABSTRACT

This textbook for emergency medical personnel should be useful to fire departments, private ambulance companies, industrial emergency and rescue units, police departments, and nurses. The 30 illustrated chapters cover topics such as: (1) Emergency Medical Service Vehicles, (2) Safe Driving Practices, (3) Anatomy and Physiology, (4) Closed Chest Heart Compression and Resuscitation, (5) Bleeding Control, (6) Drug Abuse, (7) Burns and Environmental Injuries, (8) Childbirth, (9) Radiation Accidents, and (10) Post Mortem Conference-Action Evaluation. Also included are data on cardiac monitoring and telemetry, a glossary, and a bibliography. A separate text to be used in presenting the skills of rescue is presently being developed. This document was developed by a state consultant with assistance from a medical advisory and review committee, and is a revision of ED 016 836. (JS)

ED 063499

EMERGENCY VICTIM CARE


AMBULANCE
MOBILE CORONARY CARE

STATE BOARD OF EDUCATION OHIO

Division of Vocational Education
State Department of Education
Columbus, Ohio

VT015656

EMERGENCY VICTIM CARE

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

A

TEXT BOOK

FOR

EMERGENCY MEDICAL PERSONNEL

OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

DIVISION OF VOCATIONAL EDUCATION
STATE DEPARTMENT OF EDUCATION
COLUMBUS, OHIO

"PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL HAS BEEN GRANTED BY T&I Educ Servic
Instruc Materials Lab
Ohio St Univ
TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE U.S. OFFICE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER."

Copyright - 1971

Trade and Industrial Education Service

Edited and distributed by the:
Instructional Materials Laboratory
Trade and Industrial Education
The Ohio State University
College of Education
Columbus, Ohio 43210

Reprint — 1972

IN MEMORY OF

In memory of the two state certified emergency and rescue instructors who lost their lives in the line of duty in service to their fellowman.

Captain C.F. Martin
Emergency Squad
Columbus, Ohio, Fire Department

Captain William O. Bird
Rescue Squad
Sandusky, Ohio, Fire Department

PREFACE

The Trade and Industrial Education Service within the Division of Vocational Education, the State Department of Education, has assisted public schools to provide training in Trade and Industrial occupations to the citizens of Ohio since 1918. Its purpose has been to prepare young men and women for employment in all types of industrial and service work, as well as to upgrade adult workers for greater efficiency in their chosen field.

Ohio can be truly proud of the vocational instruction provided to local communities in emergency victim care training. This training has undoubtedly been responsible in alleviating suffering and saving many lives in the state. Emergency victim care training has been developed to serve the citizens of Ohio by providing well qualified persons to deal with emergency situations. The personnel trained may be members of fire departments, police departments, or other agencies who are involved in the emergency treatment and transport of the sick and injured.

This new and expanded volume is designed to serve as a text for emergency victim care training and includes the latest information on sound practices in emergency medical care.

Martin Essex, Superintendent
of Public Instruction

Byrl R. Shoemaker
Director of Vocational Education

FOREWORD

The Ohio Trade and Industrial Education Service, Division of Vocational Education, of the State Department of Education, has taken an active part in the training of emergency medical personnel since 1958. Through the development and utilization of part-time instructors, the Trade and Industrial Education Service has provided training to fire departments, both paid and volunteer, private ambulance companies, industrial emergency and rescue units, police departments, and nurses.

In 1959 the original emergency and rescue squad manual was published by the Ohio Trade and Industrial Education Service; it was completely revised in 1965 under the title "Emergency Victim Care and Rescue."

This new text was developed specifically to serve the emergency medical service. It contains portions of the previous text that have been revised and expanded, plus many new chapters covering the latest emergency victim care procedures. A second text is being developed to present the necessary skills of rescue.

It is our sincere desire that the emergency medical personnel throughout Ohio will realize the ultimate benefits to be gained by the use of this text as a part of all squad training programs.

Harry F. Davis
Assistant Director, Vocational Education
Trade and Industrial Education Service

JOHN J. GILLIGAN, Governor

State of Ohio

450 East Town Street
P.O. Box 118
Columbus, Ohio 43216

Department of Health

The basic factor in quality care of the ill and injured is training, resulting in individual competence whether it be that of a physician, a nurse, or an emergency medical technician.

Emergency Medical Services in Ohio are in an enviable position. The Department of Education's Emergency Victim Care training program has and continues to lead the way in providing the practical knowledge and application of paramedical skills to emergency medical situations.

Any informed physician aware of the work and accomplishments of this course must respect and have considerable admiration for it.

My very best wishes to those who have made it an outstanding vehicle for quality care and my anticipated hope is that it continues to reach still more emergency medical personnel.

T. A. Gardner

T. A. Gardner, M.D.
Acting Director of Health

ACKNOWLEDGMENT

This new and expanded text was prepared and developed by Rocco V. Morando, State Consultant, Emergency and Rescue Training, Vocational Trade and Inudstrial Education Service, The Ohio State University.

Emergency victim care training is made available to the emergency medical personnel of Ohio through the cooperative efforts of many agencies and individuals, with special recognition to C. Willis Troy, Specialist, Emergency and Rescue Training, who coordinated many of the field training programs during the development of this textbook.

To provide accepted procedures for emergency medical care, a medical advisory and review committee has given assistance on the chapters pertaining to victim care. This committee consisted of the following:

William Hamelberg, M.D.
Paul H. Curtis, Jr., M.D.
Thomas Williams, M.D.
John G. Boutselis, M.D.
Ronald Berggren, M.D.
Roy L. Donnerberg, M.D.
Fred M. Kapetansky, M.D.
Richard M. Ward, M.D.
C. Joseph Hatfield, M.D.
Wesley Furste, M.D.

The Ad Hoc Committee for Emergency Victim Care Training is chaired by:

Stuart S. Roberts, M.D.
The Ohio State University
College of Medicine

The Emergency Victim Care text and training program is officially recognized by the following agencies and associations:

- The Ohio Department of Health
- The Ohio Department of Highway Safety
- The Ohio Emergency Medical Services Coordinating Program
- The Ohio Fire Service Training Advisory Committee Representing the Following:
    - --The Ohio Fire Marshal's Office
    - --The Ohio Inspection Bureau
    - --The Ohio Fire Chiefs' Association
    - --The Ohio State Firemen's Association
    - --The Ohio Association of Professional Fire Fighters
    - --The International Fire Chiefs' Association

The Trade and Industrial Education Service also wish to acknowledge the following individuals, institutions, associations, and manufacturers for permission to use pictures, illustrations, and other material and assistance in the preparation and development of this text:

J.D. Farrington, M.D.
Archer S. Gordon, M.D.
Robert C. Waltz, M.D.
Robert M. Reese, Ph. D.
Joanne K. Littell
Barbara Weinert

St. Anthony Hospital, Columbus
The Ohio State University Hospital, Columbus
Euclid General Hospital, Euclid

The Central Ohio Heart Association
The American Heart Association
The American Diabetes Association
The Franklin County Cancer Association
The Lost Chord Club of Columbus

Yorkville Fire Department
Martins Ferry Fire Department
Newark Fire Department
Prairie Township Fire Department
Springfield Fire Department
Minerva Park Fire Department
Sharon Township Fire Department
Millersport Fire Department
Northern Hills Fire Department
Greenfield Township Fire Department
Clinton Township Fire Department
Harrison Township Fire Department, Fort McKinley Station
Sharonville Fire Department
Groesbeck Fire Department

Puritan Equipment, Inc.
Hudson Oxygen
Dyna-Med, Inc.
Linde Company
Acropolis Books-Colortone, Inc.
Blackhawk Manufacturing Company
Fairfield Surgical and Medical-Electronics, Inc.
Ferno-Washington, Inc.
The Horton Company
The C.V. Mosby Company
Dave Ellies Industrial Design, Inc.
Dayton Tech Art Co.

TABLE OF CONTENTS

Page
PREFACE iv
FOREWORD v
ACKNOWLEDGEMENT vii

CHAPTER
I EMERGENCY MEDICAL SERVICE VEHICLES 1
  Local Needs and Responsibilities 1
  Types of Emergency Medical Service Vehicles 2
  Recommended Specifications for The Emergency Ambulance 5
  General Vehicular Design 6
  Vehicle Care and Maintenance 9

II EQUIPMENT 13
  Resuscitation and Oxygen Administration 13
  Fracture Equipment 16
  Dressings and Bandages 20
  Prevention and Treatment of Shock 21
  Poison Kits 21
  Burn Kits 22
  Sterile Obstetrical Kit 22
  Stretchers and Cots 23
  Special Equipment for Use by Physician or Others Trained in its Use 23
  Light Rescue Equipment for Ambulance 23
  Communications Equipment 24
  Safety Equipment 24

III PERSONNEL 25
  Qualifications 25
  Complement of Emergency Ambulance Units 27

IV OPERATIONS 29
  Alerting System 29
  Response 30
  Communications 30
  Coding Calls 31

V RECORDS AND REPORTS 33
  Responsibility for Reports 33
  Important Items on Squad Reports 33
  Sample Reports 36

VI SAFE DRIVING PRACTICES 47
  Responding to the Emergency 47
  Transporting Victim to the Hospital 49

CHAPTER Page

VII CONTROLLING THE SITUATION 51
    Highway Accidents 51
    Cooperation by PrePlanning 53
    Home Situations 54
    Cooperation of the Victim 54
    Cooperation with Hospital Personnel 55
    Operations at a Crime Scene 55

VIII ANATOMY AND PHYSIOLOGY 57
    The Body Cavities and Contents 57
    The Skeletal System 60
    The Muscular System 66
    The Nervous System 69
    The Respiratory System 71
    The Circulatory System 74
    The Digestive System 77
    The Urinary System 80
    The Reproductive System 81
    The Endocrine System 83

IX PROPER EXAMINATION 85
    Priority of Emergency Care 85
    Procedures for Proper Examination 85
    Unconscious Persons 87
    Multiple Victims 88

X AIRWAY MAINTENANCE AND RESUSCITATION 89
    Stoppage of Breathing 89
    Manual Artificial Respiration 89
    Rescue of the Unconscious Victim 91
    Positioning the Victim and Clearing His Upper Air Passage 93
    Opening the Air Passageway 93
    Mouth-to-Mouth Breathing 94
    Mouth-to-Airway Breathing 95
    Back-Pressure, Arm-Lift Method 98
    Manually Operated Ventilation Device 98
    Mechanical Ventilation Equipment 100
    The Manually Triggered Oxygen Ventilating Device 100
    The Automatic Cycled Oxygen Ventilator (Resuscitator) 101
    Properly Working Machines 103
    Blockage 103
    Using the Inhalator 105
    Suctioning of the Mouth and Upper Air Passage . . . 106

CHAPTER Page

X AIRWAY MAINTENANCE AND RESUSCITATION (continued)
Oral Airways 107
Emergency Care of the Laryngectomy Victim 108
Extra Equipment 111

XI CLOSED CHEST HEART COMPRESSION AND RESUSCITATION 113
Signs/Symptoms 113
Procedure 114
Use of Mechanical Equipment 117
Complications 119
Transportation 119

XII OXYGEN THERAPY 121
Basic Procedure 121
Safe Practices 127
Mass-Emergency Oxygen Therapy 128

XIII BLEEDING CONTROL 131
Facts Concerning Blood and Bleeding 131
Bleeding Classification in Reference to Time 131
Bleeding Classification in Reference to Source . . . 131
Emergency Care, External Bleeding 132
Emergency Care, Internal Bleeding 135

XIV SHOCK 137
Types of Shock 137
Oligemic Shock 137
Neurogenic Shock 140
Cardiorespiratory Shock 140
Anaphylactic Shock 141

XV MEDICAL EMERGENCIES 143
General Information About Heart Attack 143
Angina Pectoris 146
Technical Instructions for Squadmen Concerning Coronary Attack 147
Chronic Heart Failure 149
Stroke 150
Diabetic Reactions 152
Poisons 156
Contagious Diseases 161
Emphysema 163
Asthma 164

CHAPTER Page

XV MEDICAL EMERGENCIES (continued)
  Epilepsy and Convulsions 164
  Convulsions in Children 165

XVI THE MENTALLY DISTURBED 167
  Care of Emotionally Disturbed People in Large Scale Emergencies 167
  Common Mental Disturbances 170
  Transport of the Mentally Disturbed 171
  Alcoholism 172

XVII DRUG ABUSE 173
  Types of Drugs and Their Effects 173
    Narcotics 173
    Amphetamines 174
    Barbiturates 175
    Hallucinogens 176
    Marijuana 177
  Emergency Care and Management 178
  Drug Laws (Ohio) 179

XVIII FRACTURES 185
  Types of Fractures 185
  General Signs and Symptoms 185
  Essential Points in Emergency Care of Fractures . 186
  Immobilization Equipment and Material 187
  Types of Splints 187
  Blanket Roll Splints 189
  Specific Fractures—Signs—Symptoms and Care . . . 191
    Skull Fractures 191
    Spine Fractures (Neck and Back) 192
    Neck Fractures 192
    Back Fractures 194
    Pelvic Fractures 194
    Nose Fractures 195
    Upper Jaw or Cheekbone Fractures 196
    Lower Jaw Fractures 196
    Rib Fractures 196
    Collarbone Fracture 197
    Shoulder Blade Fractures 198
    Upper Arm Fractures 198
    Elbow Fractures 199
    Lower Arm Fractures 199
    Wrist and Hand Fractures 199
    Hip Fractures 200
    Thigh Fractures 201
    Knee Fractures 201

CHAPTER Page

XVIII FRACTURES (continued)
    Lower Leg Fractures 202
    Ankle Fractures 202
    Foot Fractures 203

XIX DISLOCATIONS 205
  General Signs and Symptoms 205
  Emergency Care in General 205
  Specific Dislocations 206
    Lower Jaw 206
    Shoulder 207
    Elbow 207
    Wrist 207
    Finger or Toe 208
    Hip 208
    Knee or Kneecap 209
    Ankle 209

XX WOUNDS AND BANDAGING 211
  Types of Wounds 211
    Abrasions 211
    Incised 211
    Lacerated 211
    Puncture 212
  Avulsions (Severed Body Parts) 212
  Dressings and Bandages 212
    Triangular 213
    Cravat 216
    Roller 218

XXI INJURIES OF THE EYE, EAR, NOSE, CHEST, ABDOMEN AND GENITALIA 223
  Eye Injuries 223
  Ear Injuries 228
  Nose Injuries 228
  Chest Injuries 229
  Abdominal Injuries 231
  Genitalia Injuries 234

XXII BURNS AND ENVIRONMENTAL INJURIES 235
  Burns 235
  Classification of Burns 235
  Evaluation of Burns 237
  Emergency Care of Burns 237
  Cold Injuries 239
  Abnormal Lowering of Body Temperature 240

CHAPTER Page

XXII BURNS AND ENVIRONMENTAL INJURIES (continued)

Emergencies Due to Heat 241
Heat Exhaustion 241
Heat Cramps 241
Heat Stroke (Sun Stroke) 242

XXIII CHILDBIRTH 243
Normal Deliveries 243
Final Steps in Emergency Childbirth 254
Unusual Deliveries 254
Other Childbirth Emergencies 255
Abortion or Miscarriage 255
Emergency Baptism of the Fetus or Embryo 256
Emergency Baptism for Dying Infants and Babies 256

XXIV USE OF BACKBOARDS 257
Logrolling 257
Handling of Backboards 263

XXV MOVING AND HANDLING THE VICTIM 267
From a Bed 267
From a Couch 269
The Stair Chair 270
The Scoop Stretcher 272
Carries and Drags 275

XXVI EXTRICATION FROM AUTOMOBILES 283
The Highway Accident 283
Entry to the Victim — Release from Entrapment . . 284
Removal of Victims from an Automobile 289
Multiple Victim Removal 302

XXVII ELECTRICAL EMERGENCIES 305
Recognizing the Danger 305
Acting in an Emergency 306
Handling Energized Wires 307
Removing Victim from Wire 309
Emergency Care after Rescue 309

XXVIII RADIATION ACCIDENTS 311
Standing Orders for Emergency Handling of Radiation Accident Cases 311
The Victim(s) 312

CHAPTER Page

XXVIII RADIATION ACCIDENTS (continued)

Emergency Squad Personnel 312
Hospital Personnel 312

XXIX POST-MORTEM CONFERENCE (ACTION-EVALUATION) 315
Why Conduct a Post Mortem Conference? 315
How to Conduct the Conference 315
Scheduling a Conference 316
Responsibility and Participation 316
Items to be Evaluated 317

XXX LEGAL ASPECTS 319
Level of Care 319
Victims Refusing Emergency Care 319
Operation of the Vehicle 319
Statutes from Ohio Revised Code 320

Appendix I PROPHYLAXIS AGAINST TETANUS 327

Appendix II CARDIAC MONITORING AND TELEMETRY 333

GLOSSARY OF TERMS 339

BIBLIOGRAPHY 353

CHAPTER I

EMERGENCY MEDICAL SERVICE VEHICLES

INTRODUCTION

Many of the residents of our communities today are the unfortunate and innocent victims of tragedies and disasters which, needless to say, are increasing in alarming numbers. As more and more traffic accidents, drownings, fires, explosions, tornadoes, floods, airplane crashes, and many other misfortunes occur, there is a tremendous need for well trained men and special equipment to handle these situations. It is a recognized fact that saving lives is of paramount importance where these emergencies occur. But it also must be recognized that the necessary equipment must be on hand to do the job. Emergency medical units are being organized in steadily increasing numbers throughout the nation, to cope with these new demands. Encouragement to groups of men trying to organize such units is of vital importance. One way to do this is to make certain they are provided with the best training and the best equipment to make them into an efficient life-saving and rescue unit.

LOCAL NEEDS AND RESPONSIBILITIES

Adequate emergency ambulance services are as much a governmental responsibility as firefighting and law enforcement. If the local community does not provide this service directly, they should then satisfy themselves that the quality of the existing services meets the accepted standards of emergency medical care. Emergency ambulance services should also include a program of mutual aid with other communities to guarantee efficient operations in cases of natural disasters or large scale emergencies such as plane crashes, explosions and similar situations where large numbers of people may be involved.

To establish the adequate emergency ambulance service, the following items must be incorporated:

1. Organization: Complete cooperation with all civic, professional, industrial, and medical associations and agencies.

2. The Vehicle: So designed and equipped to insure the ultimate in emergency care at the scene, and enroute to the hospital.

3. Equipment: Sufficient equipment to administer emergency care within the range of those situations that may be encountered.

4. Training: All personnel to be trained to administer the ultimate in emergency care and to properly utilize the tools of the service.

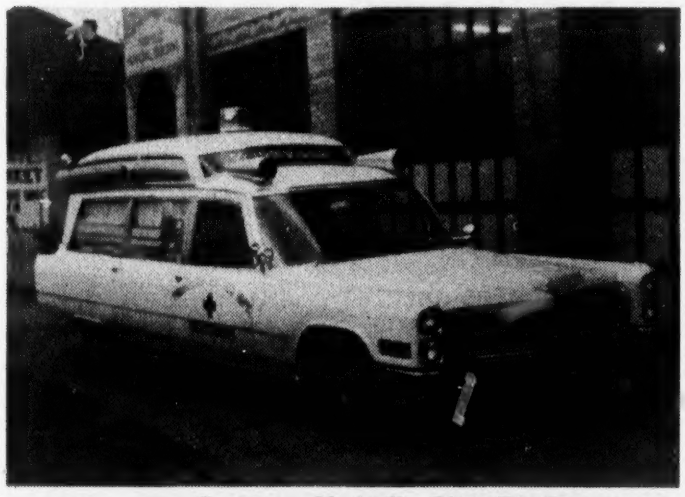
5. Communication: Two-way radios linking all vehicles with a base station and the hospital emergency room.

TYPES OF EMERGENCY MEDICAL SERVICE VEHICLES

INTRODUCTION

The majority of vehicles being used in the response to the scene of accident or serious illness can be broken down into four categories: the modified hearse or passenger vehicle, the carry-all type, the delivery van, and the replaceable module type. There are various designs built today by reputable manufacturers (See Figures 1 thru 4). Many of these are "stock models," but others are built according to a buyer's specification. Before an emergency squad decides to buy a vehicle they must define the purpose of their operation. If the squad is to provide the ultimate in emergency care and transportation, then the vehicle should be designed and equipped to permit its use as follows:

1. At the scene.
2. While moving a victim to or from the vehicle.
3. Enroute to a hospital.



Courtesy - Yorkville, Ohio, Fire Department

FIGURE 1A. A 54" high head-room ambulance on a commercial chassis

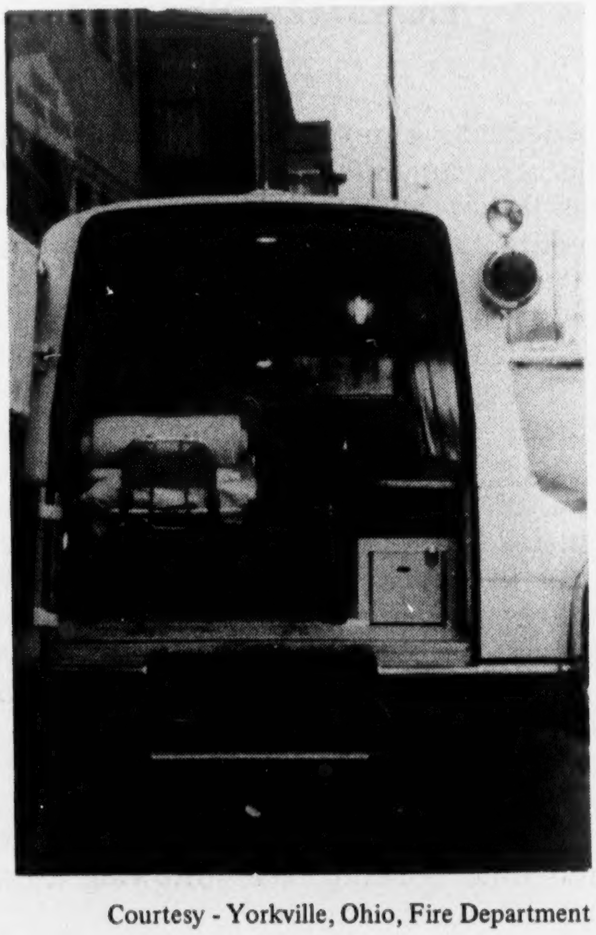
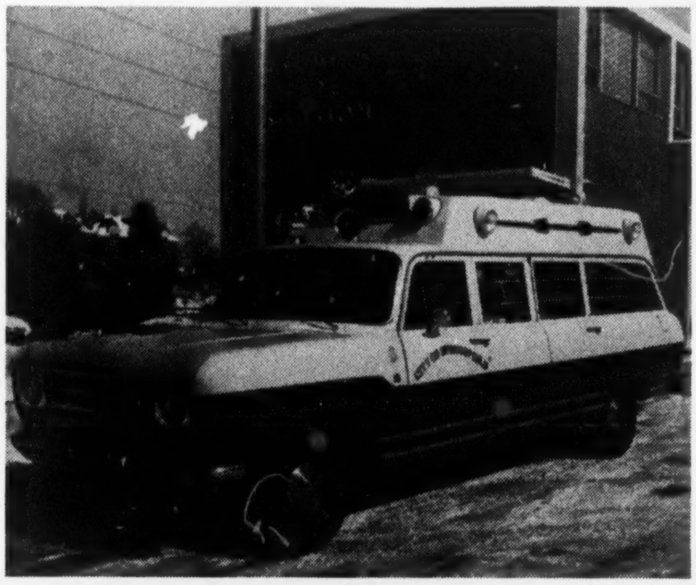


FIGURE 1B. The interior of the 54" high head-room ambulance ➔

Courtesy - Yorkville, Ohio, Fire Department

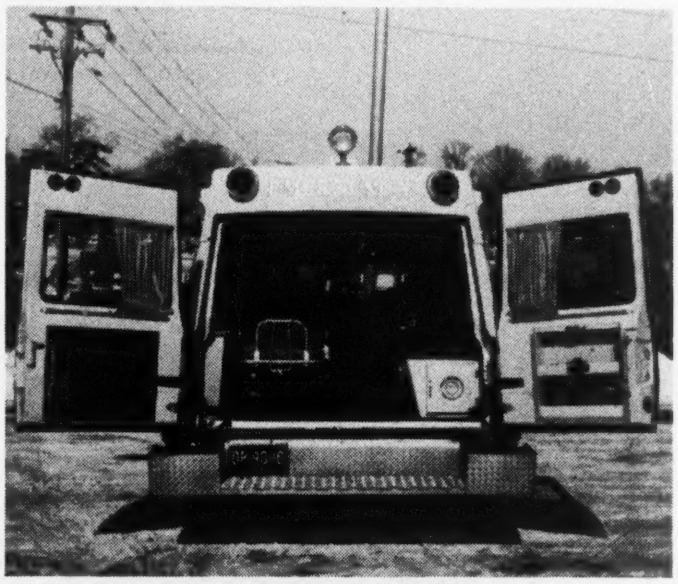
It is important that the buyer make a careful study to determine exactly what is needed and to make every effort to conform to the nationally recommended standards for ambulance design and equipment.

To be classified as an emergency ambulance, a vehicle must provide space for a driver, two squadmen, and two victims, so positioned that at least one victim can be given necessary life-support during transportation. Equipment and supplies must be carried to provide two-way radio communication, tools for light rescue procedures, and the necessary equipment and supplies to administer emergency care outside the vehicle and during transport. The vehicle must be designed and constructed to afford maximum safety and comfort and to avoid aggravation of the victim's condition.



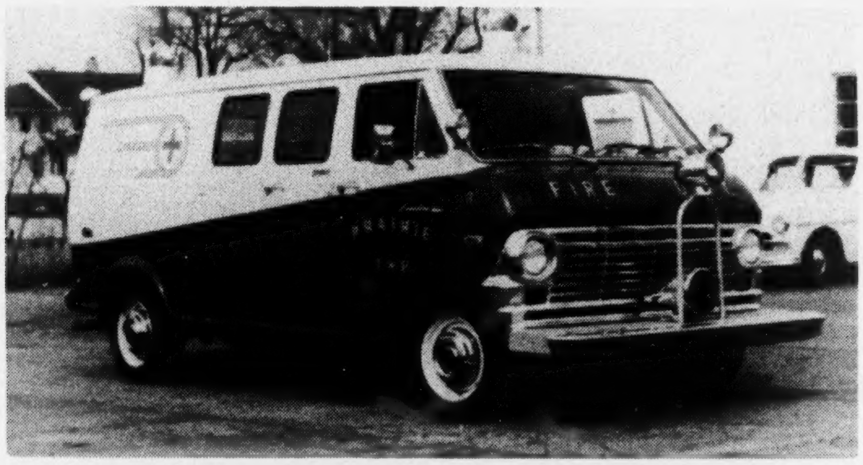
Courtesy - Springfield, Ohio, Fire Department

FIGURE 2A. The modified carry-all type of ambulance



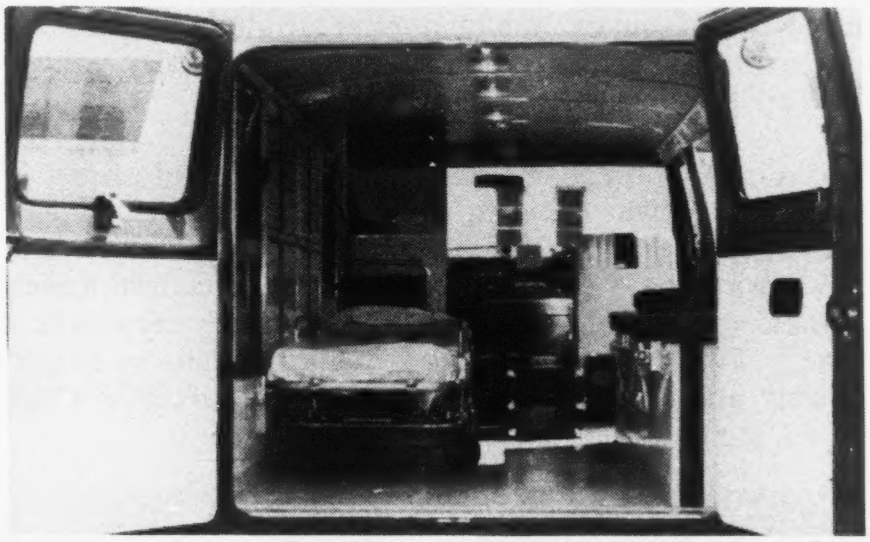
Courtesy - Springfield, Ohio, Fire Department

FIGURE 2B. The interior of the carry-all type ambulance



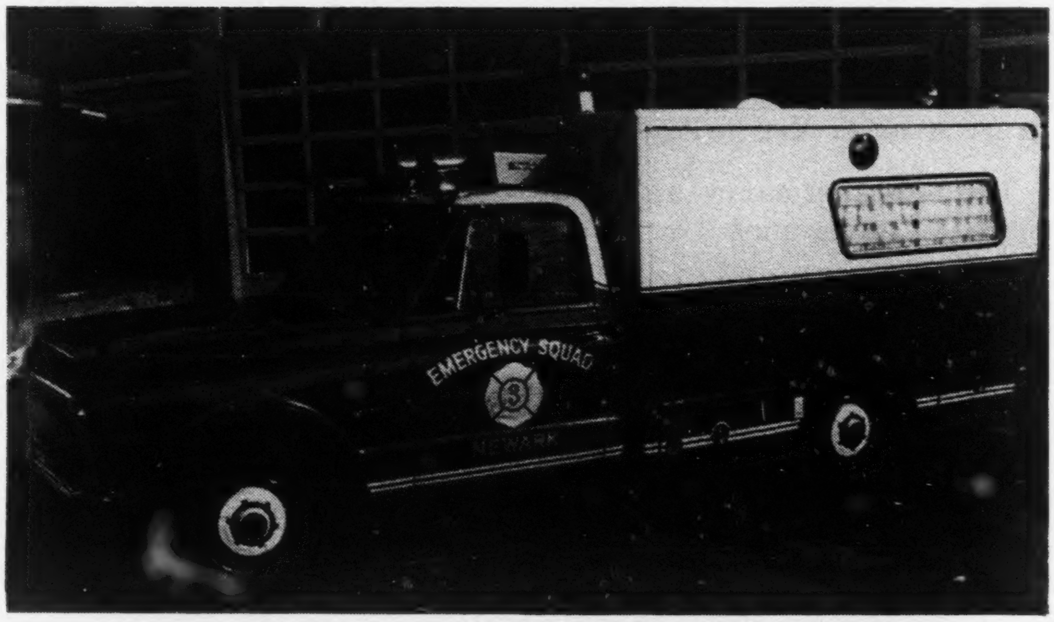
Courtesy - Prairie Township Fire Department, New Rome, Ohio

FIGURE 3A. The modified delivery van type ambulance



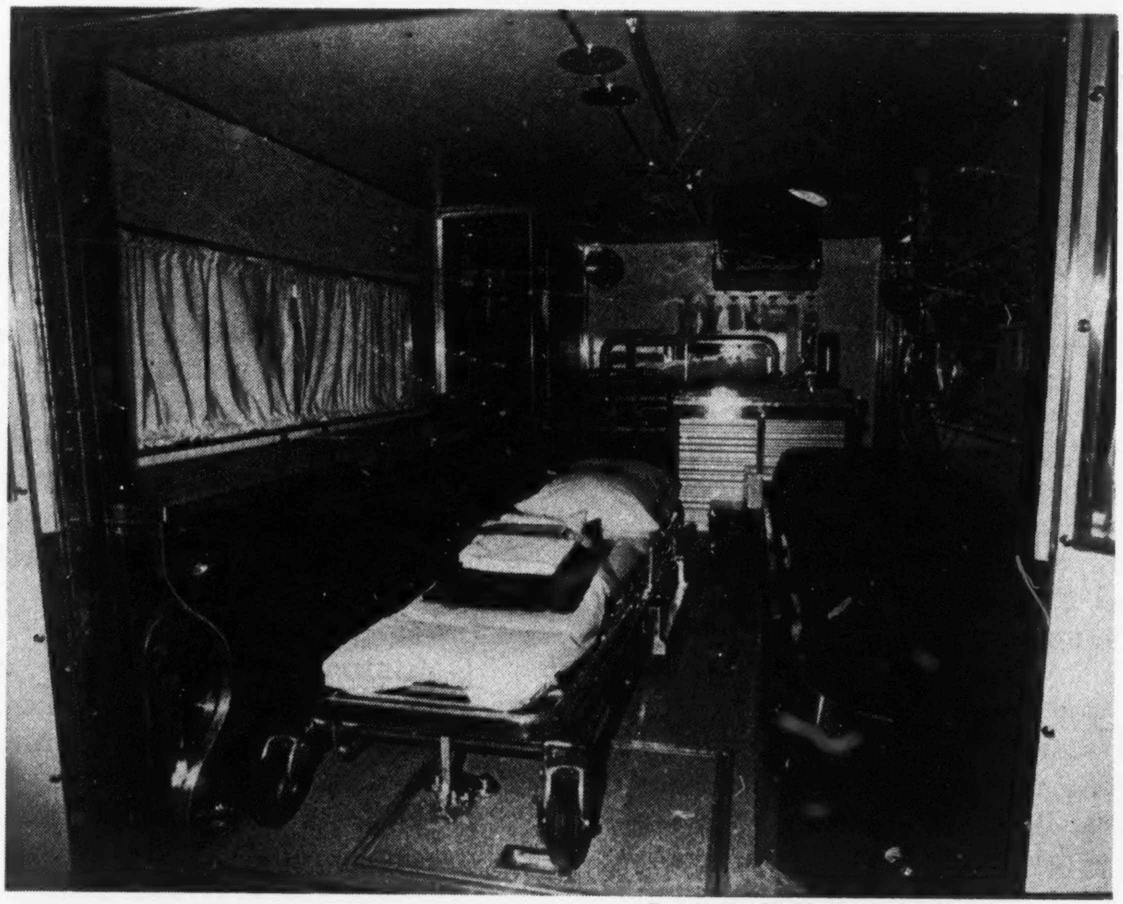
Courtesy - Prairie Township Fire Department, New Rome, Ohio

FIGURE 3B. The interior of the delivery van type ambulance



Courtesy - Newark, Ohio, Fire Department

FIGURE 4A. The replaceable module type ambulance



Courtesy - Newark, Ohio, Fire Department

FIGURE 4B. The interior of the replaceable module type ambulance

RECOMMENDED SPECIFICATIONS FOR THE EMERGENCY AMBULANCE

The following information is a reprint from the publication entitled "Medical Requirements for Ambulance Design and Equipment," National Research Council, National Academy of Sciences, Division of Medical Sciences, and was prepared by its subcommittee on ambulance services. The requirements and recommendations listed reflect the committee's projection to the eventual development of a prototype that will completely fulfill the mission in providing emergency medical services. However, every buyer should, at the present time, seek the total cooperation of their manufacturer to incorporate as many of the recommendations as possible relative to today's engineering and production limitations.

GENERAL VEHICULAR DESIGN

General Safety Standards. The ambulance must comply with motor-vehicle safety standards as may be issued by the United States Department of Transportation.

Identification of ambulances should be distinct from that of other emergency vehicles, with nationally uniform emblem, color, intermittent audible warning signal, and flashing roof light for easy recognition and to ensure traffic priority.

Speed and Acceleration. Because rapid and safe arrival of an ambulance at the scene of an accident or in case of the onset of life-threatening illness may be essential to survival, the vehicle must be capable of acceleration comparable with that of other passenger-carrying vehicles; however, optimum preparation before transport and the requirements of comfort, safety, and avoidance of aggravation of the patient's condition preclude excess speed, rapid acceleration, or traffic violation, in delivery of the patient to a medical facility.

Riding characteristics must ensure smooth, gentle, and comfortable transportation. Ease and reliability of handling are essential. The ambulance should be equipped with a positive-traction differential. Provision for four-wheel drive may be necessary in areas where required by the terrain. The braking system should be adequate. There should be minimal pitch, roll, and side-wind effect. The center of gravity should be as low as possible for ease of loading and maximum stability. Puncture-proof tires are essential. Road clearance must be adequate for country roads or disrupted city streets. Underseal of the body is desirable to avoid flooding.

The floor should be at the lowest level consistent with adequate clearance and the space for litters and for attendants at the ends and sides should have a flat surface and be unencumbered by wheel wells, drive shaft tunnels, etc. It should have a nonskid surface that is easily cleaned.

Collision reinforcing bars should be incorporated in the sides and rear and roll bars or other reinforcement should be incorporated in the roof, to protect occupants in the event of an accident.

The electrical power supply provided by the motor should be capable of producing sufficient current at 12 volts to meet such vehicular requirements as lighting, radio, and temperature control, and the battery should be of sufficient capacity to function for at least 20 minutes with the motor not running. In addition, a 110-volt, at least 3000-watt, power supply must be provided for installed and portable equipment.

DRIVER AREA

Separation from the patient area is essential to afford privacy for radio communication and to protect the driver from an unruly patient. The bulkhead must be strong enough to support an attendant's seat in the patient area at the top of the patient's head and to withstand deceleration forces of the attendant in case of accident.

Access to the driver area is to be provided by two doors, one on each side. Access to the patient area must be either direct (by passing through an opening in the bulkhead) or indirect (by leaving the driver area and entering an external door to the patient area). There must be provision for both visual and voice communication between the two compartments.

Lighting must be available for both the driver and an attendant, if riding in the driving compartment, to read maps, records, etc. There must be shielding of the driver's area from the lights in the patient compartment.

Environmental control should allow for adequate ventilation, heating, and cooling. This equipment must be capable of reaching 75° F in a reasonable time and maintaining this temperature under various operating conditions. Rapid air exchange (ventilation) may prove necessary under certain circumstances--for instance, during the transport of gas-contaminated victims. Entry of exhaust gases must be avoided.

Safety requirements for the driver area include restraining devices, dash padding, collapsible steering wheel, and such other safeguards as prescribed by the Department of Transportation.

Communication equipment requiring space in the driver area consists of two-way radio, a tachograph, maps, manuals, and such records as the driver may need to maintain.

PATIENT AREA

Over-all dimensions of the patient area must provide for two litters (each 76 inches long and 23 inches wide), two attendants, space for administering life-supporting care, and all equipment and supplies not carried in the driver area or on the outside of the vehicle.

Minimum space between the head of the litter and the bulkhead must be 25 inches, including a seat for an operator who sits at the patient's head for respiratory care and resuscitation.

Minimum space at the foot of the litters must be 15 inches to accommodate traction splints and/or an attendant. The handle of folding litters that extend beyond 76 inches are accommodated within this space.

Minimum space between litters must be 25 inches to provide room for the operator to kneel while performing external cardiac compression and other functions.

The minimal height throughout this area is 54 inches from floor to ceiling. A height of 60 inches is preferable. The minimal height affords only 39 inches from the surface of the litter to the ceiling when the litter is adjusted to a height of 15 inches, to allow an operator to kneel beside the patient on a pillow and use maximal body weight in performing cardiac compression with his arms straight.

In summary, the minimal over-all internal dimensions of the patient area are: width, 71 inches (2 litters 23 inches wide plus 25-inch space between litters); length, 116 inches (25 inches at the head plus 15 inches at the foot of a 76-inch litter); and height, 54 inches from floor to ceiling.

Crash-stable fasteners must be provided to secure litters to the floor or side walls. Litters must not be suspended by wall brackets or from the ceiling. Where a single patient may be centered in the area on the wheeled litter, additional attachments should be provided. Floor and side-wall attachments should be flush with the surface when not in use.

Seats must be provided for attendants, one at the top of the patient's head, as described above. In addition, seating space with restraints should be provided for ambulatory patients, for example, in the form of a fixed bench, otherwise used to support a folding litter.

Equipment, installed or portable, and all supplies must be positioned for ready accessibility and not impinge on litter or access areas. Storage cabinets and installed equipment should be designed or positioned to avoid projecting injurious objects, including recessed ceiling hooks for suspension of intravenous-fluid containers.

Doors must be provided at the rear and curbside at the front of the patient area. The rear doors should be hinged to open flush with the sides and ceiling of the patient area and stabilized in the open position to permit litters to be placed into their ultimate riding positions with minimum movement of patients. Latches should permit easy opening with one hand. The curbside door must allow the attendant to position himself rapidly and easily at the head of the patient and to remove patients in an emergency if the rear door is jammed.

Steps, if present, should be built to prevent slipping and accumulation of snow, ice, or mud.

Communication with driver area, both visual and by voice, must be provided. Access to the two-way radio equipment is required for communication with dispatchers, hospitals, physicians, etc.

Illumination must be adequate throughout the compartment, and provide an intensity of 40 foot-candles at the level of the patient for adequate observation of vital signs, such as skin color and pupillary reflex, and for care in transit. Lights should be controllable from the entry doors, the head of the patient, and the driver's compartment. Windows, if present, should not encroach on necessary storage space, and, while providing daylight, should ensure patient privacy and safety.

Environmental control of the patient area must allow for adequate ventilation with doors and windows closed and for comfortable heating and cooling. The system should provide a temperature of 75° F within minutes and be able to maintain it under extremes of operating conditions. Entry of exhaust gases must be avoided.

Interior surfaces of the patient area must be insulated; resistant to water, heat, and chemicals; and easily cleaned. There should be no sharp projections that could be injurious.

Restraints for attendants must be provided and their seats must be strong enough to meet deceleration requirements of the Department of Transportation. A padded headrest should be installed above the seat fixed to the bulkhead. Restraints must also be provided for patient protection during transit, including control of the unruly or mentally disturbed patient.

Power outlets for 110 volts should be provided inside near the patient for use of specialized equipment during transport and for recharging battery-powered equipment, and outside for floodlights and electrically powered rescue tools. Receptacles should be approved, grounded units.

VEHICLE CARE AND MAINTENANCE

The care and maintenance of an emergency squad vehicle and every piece of equipment it carries is the direct responsibility, function, and obligation of those assigned to carry out this duty. Such responsibility should be delegated to dependable and reliable officers or men. But, regardless of who performs the operation, the officer in charge should direct the work and inspect the results. This procedure is not meant to infer that the men who did a clean-up job cannot be relied upon, but rather it places the different levels of responsibility where they belong. After all it is the officer's duty to see that this unit is ready to respond at all times.

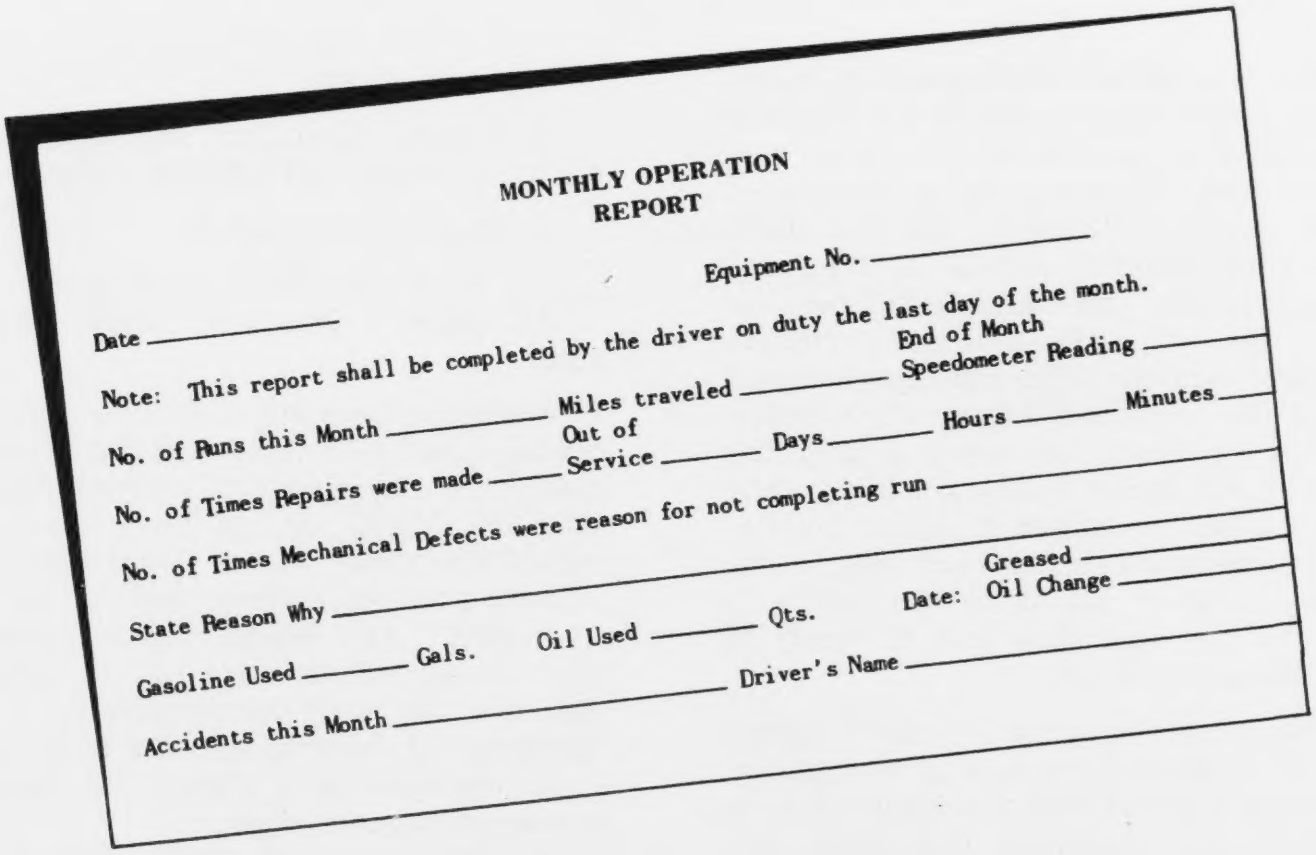
Therefore, in order to insure instant and efficient performance by an apparatus, it is imperative that certain items be checked and inspected after each run. The following list can be used as a guide to direct this inspection service. Other items can be added by the local department in accordance with existing policies, rules, and regulations.

The following items should be checked after each run for defects and services needed:

1. Brakes and their related parts
2. Gasoline and oil levels - Replenish if necessary and look for leaks.
3. Tires - Check for foreign bodies, for cuts, and for air pressure.
4. All gauges and instruments of the dash board
5. Battery, especially on radio-equipped vehicles
6. Radiator - Check water level of cooling system.
7. Safety belts
8. Lights - Head, tail, stop, directional, dash, dome, and warning lights
9. Steering mechanism
10. Mirrors - Rear and side(s)
11. Siren - Check for proper operation.

While on the subject of care and maintenance, one very important factor in this respect which must not be overlooked is CLEANLINESS. It has been very well established that one of the trademarks of any good emergency unit is its appearance. The squad vehicle must be kept clean inside and out, to protect patients as well as squadmen. The handling of contagious diseases is a good example of a reason for keeping the squad vehicle clean.

In addition to the routine inspection, it is advisable to have a complete and thorough periodic check of the automotive equipment. It is recommended that this be made on at least a monthly basis. An inspection record should be maintained on a report form, which will be filed for reference. The driver, a mechanic, or whoever is qualified or detailed to do this work as stipulated by local policy, should be held responsible for this job. Figures 5 and 6 are copies of forms used at the present time by some departments. Please note that only the signature of the person making the inspection is included on one of these, while on the other an additional signature by the officer is required. The latter definitely indicates to the officer the defects reported and his signature certifies he is aware of them. However, local policy should determine the procedure to be followed.



MONTHLY OPERATION
REPORT

Equipment No. ____

Date ____

Note: This report shall be completed by the driver on duty the last day of the month.

No. of Runs this Month ____ Miles traveled ____ End of Month Speedometer Reading ____

No. of Times Repairs were made ____ Out of Service ____ Days ____ Hours ____ Minutes ____

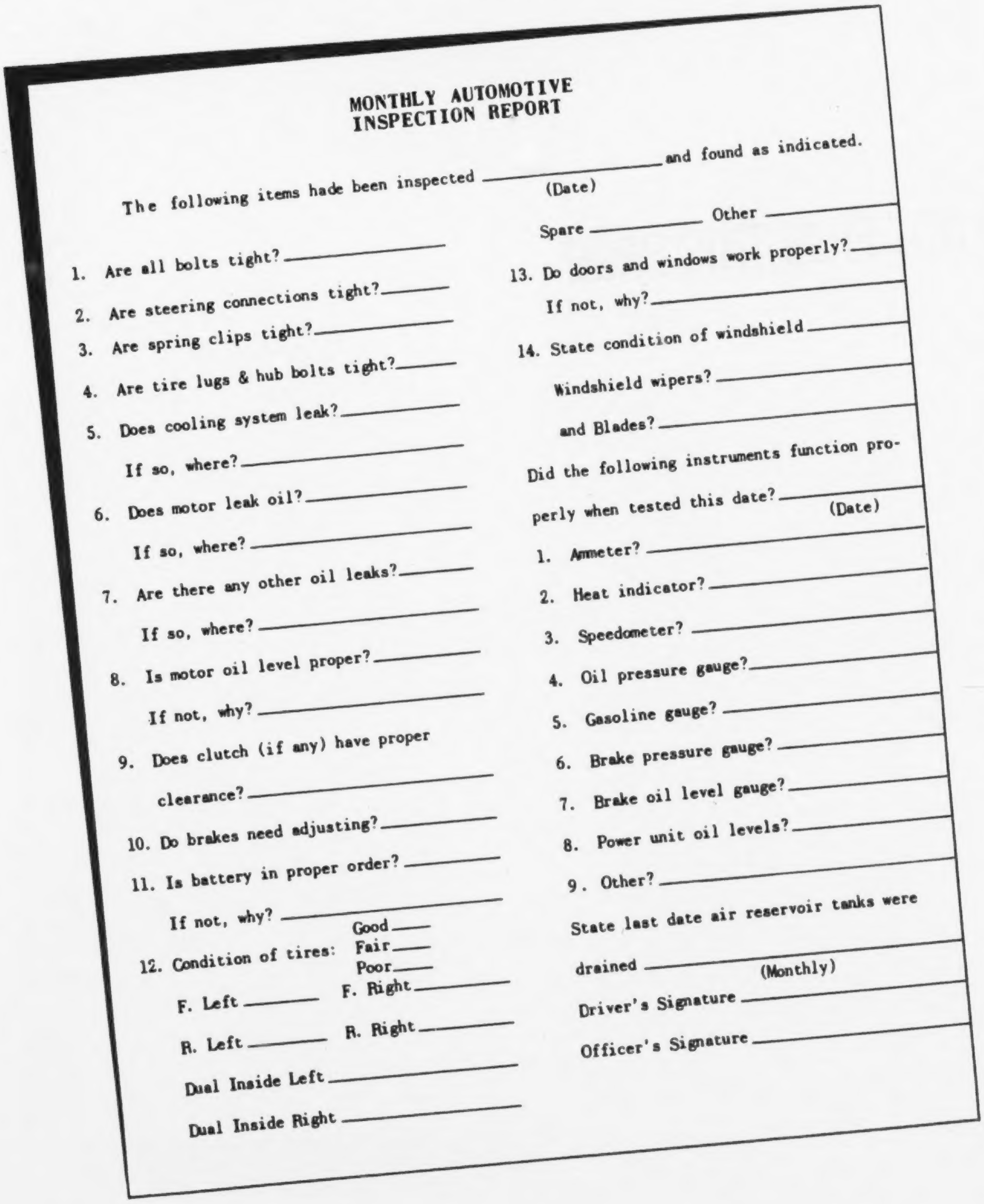
No. of Times Mechanical Defects were reason for not completing run ____

State Reason Why ____

Gasoline Used ____ Gals. Oil Used ____ Qts. Date: Greased ____ Oil Change ____

Accidents this Month ____ Driver's Name ____

FIGURE 5. Monthly operation report



MONTHLY AUTOMOTIVE
INSPECTION REPORT

The following items hade been inspected ______ and found as indicated.
(Date)

1. Are all bolts tight? ______
2. Are steering connections tight? ______
3. Are spring clips tight? ______
4. Are tire lugs & hub bolts tight? ______
5. Does cooling system leak? ______
   If so, where? ______
6. Does motor leak oil? ______
   If so, where? ______
7. Are there any other oil leaks? ______
   If so, where? ______
8. Is motor oil level proper? ______
   If not, why? ______
9. Does clutch (if any) have proper clearance? ______
10. Do brakes need adjusting? ______
11. Is battery in proper order? ______
    If not, why? ______
12. Condition of tires: Good ______ Fair ______ Poor ______
    F. Left ______ F. Right ______
    R. Left ______ R. Right ______
    Dual Inside Left ______
    Dual Inside Right ______
    Spare ______ Other ______
13. Do doors and windows work properly? ______
    If not, why? ______
14. State condition of windshield ______
    Windshield wipers? ______
    and Blades? ______

Did the following instruments function properly when tested this date? ______
(Date)

1. Ammeter? ______
2. Heat indicator? ______
3. Speedometer? ______
4. Oil pressure gauge? ______
5. Gasoline gauge? ______
6. Brake pressure gauge? ______
7. Brake oil level gauge? ______
8. Power unit oil levels? ______
9. Other? ______

State last date air reservoir tanks were drained ______
(Monthly)

Driver's Signature ______

Officer's Signature ______

FIGURE 6. Monthly automotive inspection report

CHAPTER II

EQUIPMENT

INTRODUCTION

When an emergency occurs in which life is in jeopardy, it is essential that all necessary equipment be available to provide proper emergency care at the scene and enroute to the hospital.

The equipment must be maintained in operable condition at all times, and personnel assigned to the vehicle must be thoroughly trained in its use.

NOTE: The following equipment is considered by the American College of Surgeons, Committee on Trauma, to be that which is essential to be carried on the emergency medical service vehicle.

Additional items pertinent to local geographic or industrial hazards should be carried.

RESUSCITATION AND OXYGEN ADMINISTRATION

ARTIFICIAL VENTILATION DEVICES

Hand operated bag-mask ventilation unit with adult, child, and infant size masks. Clear masks are preferred. The unit must be capable of accepting an oxygen supply and should be easy to clean and decontaminate. See Figure 1.

Oxygen-powered, manually triggered devices are acceptable if they can meet the requirements as specified in Chapter 10, Page 89. In a recent medical evaluation, the following advantages were cited: (1) simplicity, (2) delivery of 100 percent oxygen, (3) two hands can be used to maintain a mask fit, (4) high flow rates permitting adequate ventilation in spite of mask leaks, (5) eliminates personal contact with the victim. The only disadvantages listed are principally lack of ready availability and dependence on compressed oxygen as a source. See Figure 2.

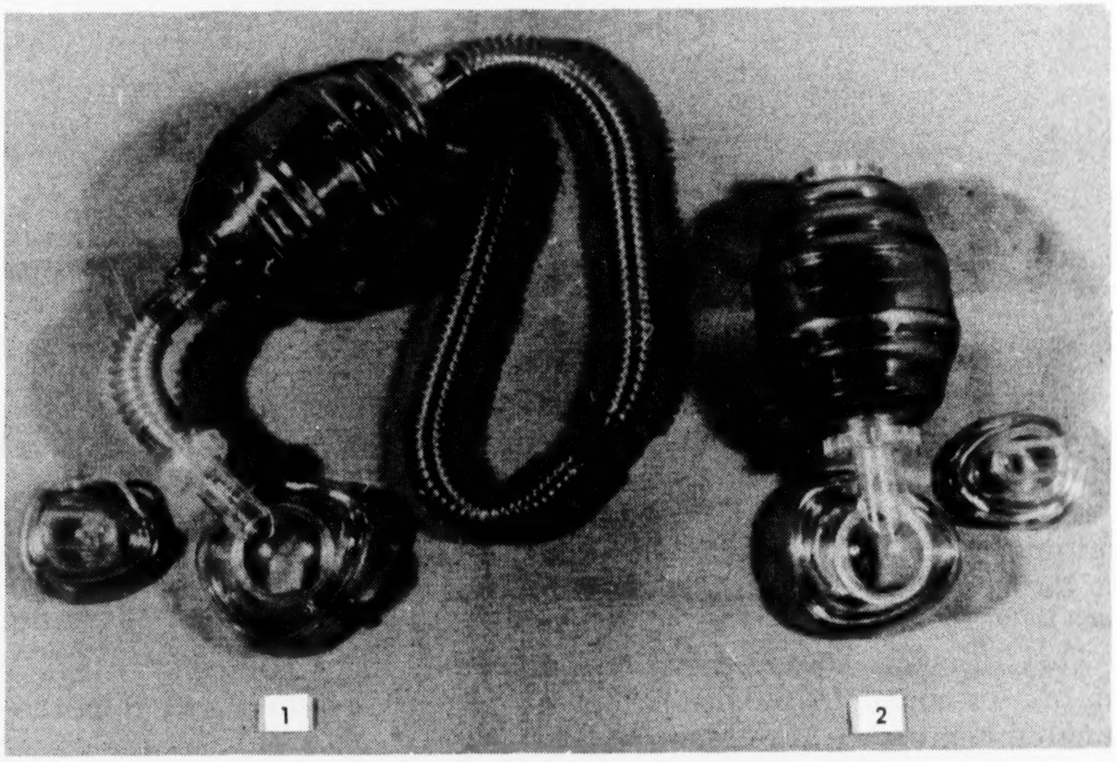
AIRWAYS

Oropharyngeal airways for adults, children, and infants should be provided. See Figure 3. S-shaped breathing tubes should be carried in sizes shown, Figure 4-(1).

Mouth gags or padded-taped tongue blades should also be provided to prevent tongue injury during convulsions. See Figure 5.

OXYGEN INHALATION EQUIPMENT

There should be two oxygen supplies, one built in, and the other portable.



(1) Hand operated bag mask with oxygen reservoir
(2) Hand operated bag mask

FIGURE 1. The bag mask resuscitator

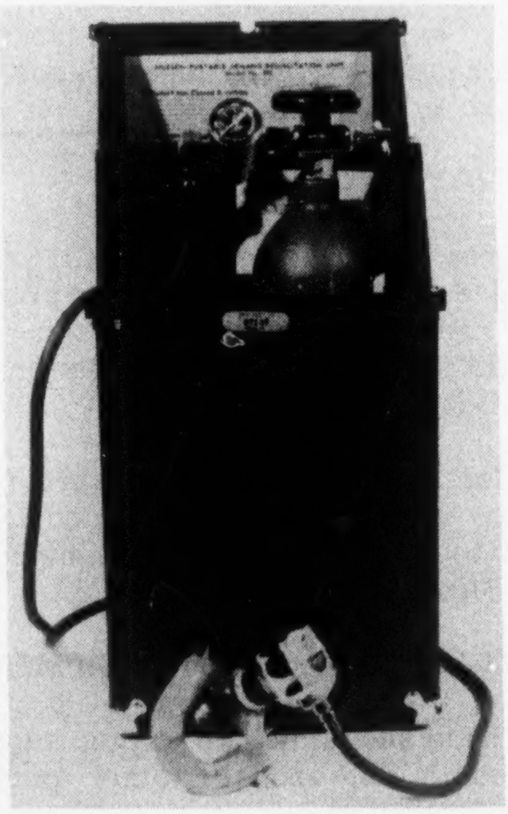
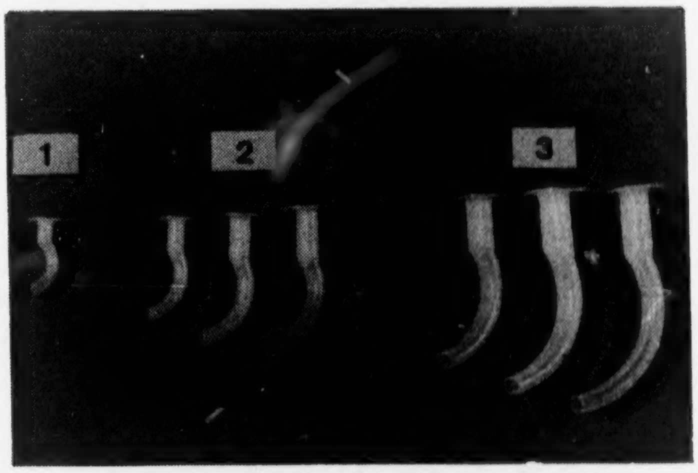
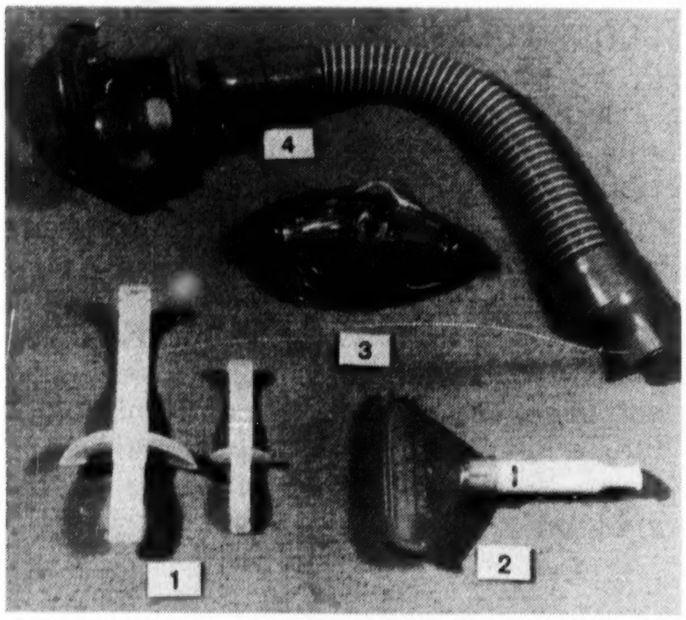


FIGURE 2. The demand valve resuscitator



(1) Infant size
(2) Children's sizes, small-medium-large
(3) Adult sizes, small-medium-large

FIGURE 3. Oropharyngeal airways



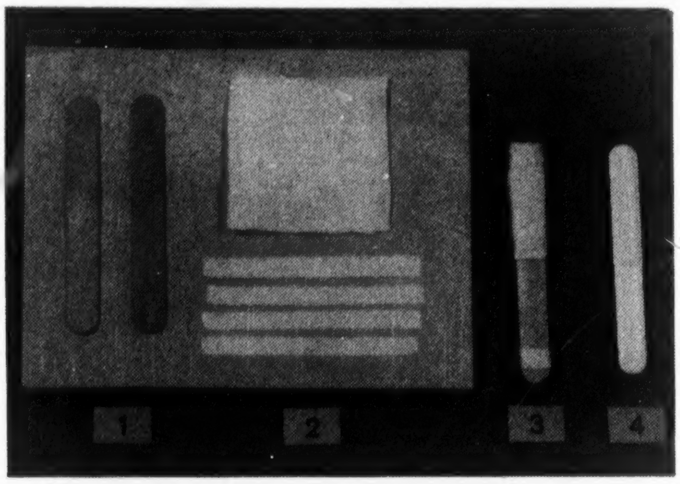
(1) S-shaped breathing tubes
(2) Venti-breather - with one way valve
(3) Tube to mask - direct breathing
(4) Mouth to mask - with exhalation valve from the victim away from rescuer

FIGURE 4. Mouth-to-mouth resuscitation adjuncts

The portable unit of 300-liter capacity (one "D" tank), equipped with a yoke, pressure gauge, and flowmeter, delivery tube, and mask; and it should be capable of delivering at least 10 liters per minute. An extra "D" tank should be available. Oxygen masks should be semi-open, valveless, transparent, disposable, and in sizes for adults, children and infants. See Figure 6.

SUCTION EQUIPMENT

Portable and built-in suction equipment must be available. It should be fitted with a large-bore, nonkinking tubing and a rigid suction tip. It should provide vacuum and flow adequate to suction the upper airway. All suction equipment should be readily accessible to the squadman, and the tube should reach the victim regardless of his position. This equipment must be easily cleaned and decontaminated. See Figure 7.



(1)-(2) Material necessary to make a padded tongue blade
(3) The completed padded tongue blade
(4) A commercial plastic tongue blade

FIGURE 5. Padded-taped tongue blades to be used as mouth gags for the epileptic and convulsing victim

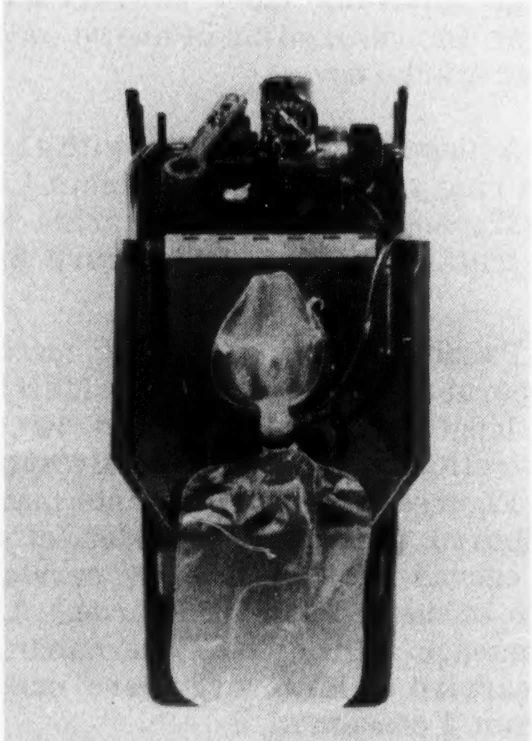
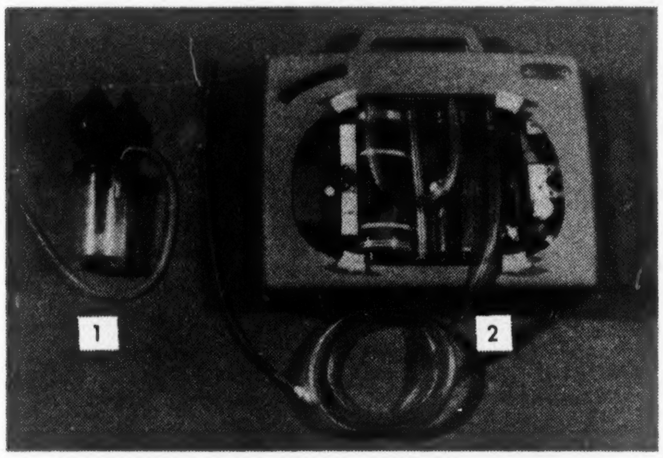


FIGURE 6. Portable oxygen inhalation unit; with a semi-open, transparent, disposable face mask



(1) Hand operated bulb-type aspirator
(2) Battery powered-portable aspirator

FIGURE 7. Suction equipment

CLOSED CHEST HEART COMPRESSION

A rigid board must be readily available to provide the proper position and resistance for effective heart compression. A special board may be used, or the long or short backboard.

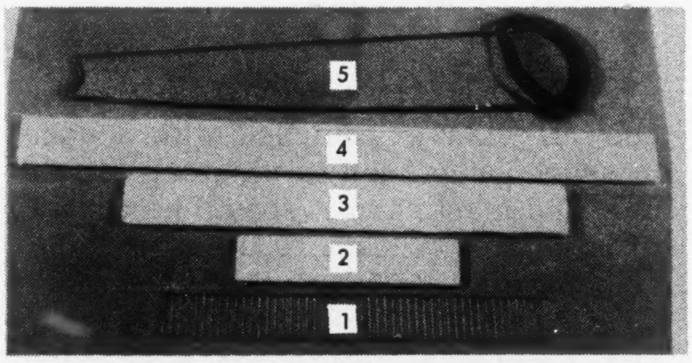
The superiority of mechanical over manual external heart compression has not been established. In anticipation of future development of mechanical equipment, space should be provided on the vehicle.

FRACTURE EQUIPMENT

The following must be carried for proper immobilization of known or suspected fractures:

A hinged half-ring splint with a minimum ring size of 9" and minimum length of 43", and with a padded ankle hitch and traction strap; See Figure 8-(5).

Padded board splints of material comparable to 4-ply wood in widths of 3" and lengths of 15", 36", and 54", and uncomplicated inflatable plastic splints. See Figures 8 and 9. (Splints made of cardboard, plastic, wire ladder, or slatted canvas lace-on may be carried in place of the 36" and 15" boards.) Local experience will dictate the number to be carried. However, there must be at least 2 of each size.

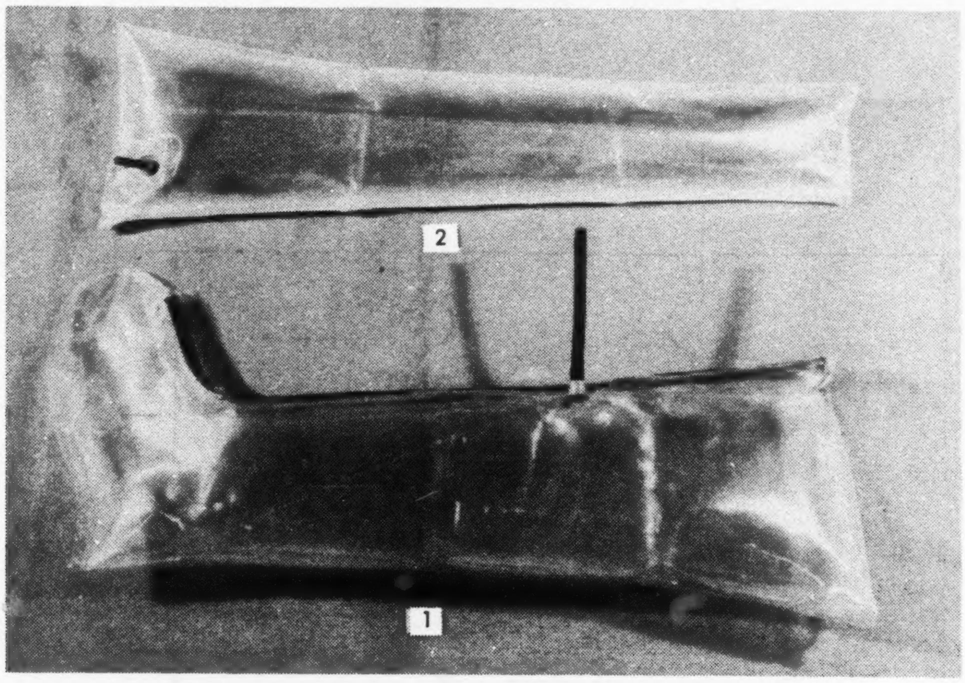


(1) The wire ladder splint
(2) Board splint - padded - 3" x 15"
(3) Board splint - padded - 3" x 36"
(4) Board splint - padded - 3" x 54"
(5) Hinged half-ring splint

FIGURE 8. Splinting equipment for proper immobilization of fractures

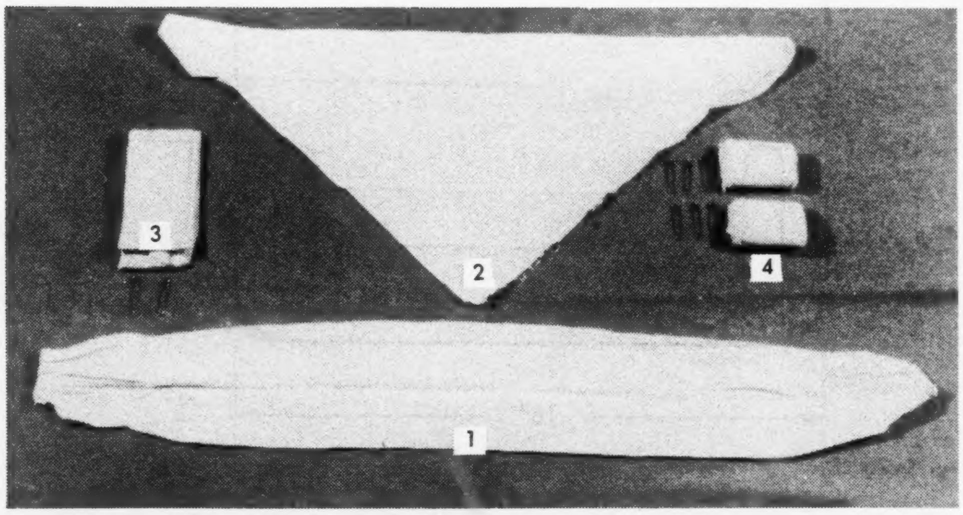
Triangular bandages with large safety pins for fractures of the shoulder and upper arm and for securing splints. See Figure 10.

Short and long backboards and straps for extrication and immobilization of known and suspected spinal injuries. See Figures 11 and 12.



(1) The full leg splint
(2) The full arm splint

FIGURE 9. Inflatable plastic splints



(1) Medium folded cravat
(2) Unfolded triangular
(3) Folded narrow cravat with large safety pins
(4) Rolled cravats for storage with large safety pins

FIGURE 10. Triangular and cravat bandages

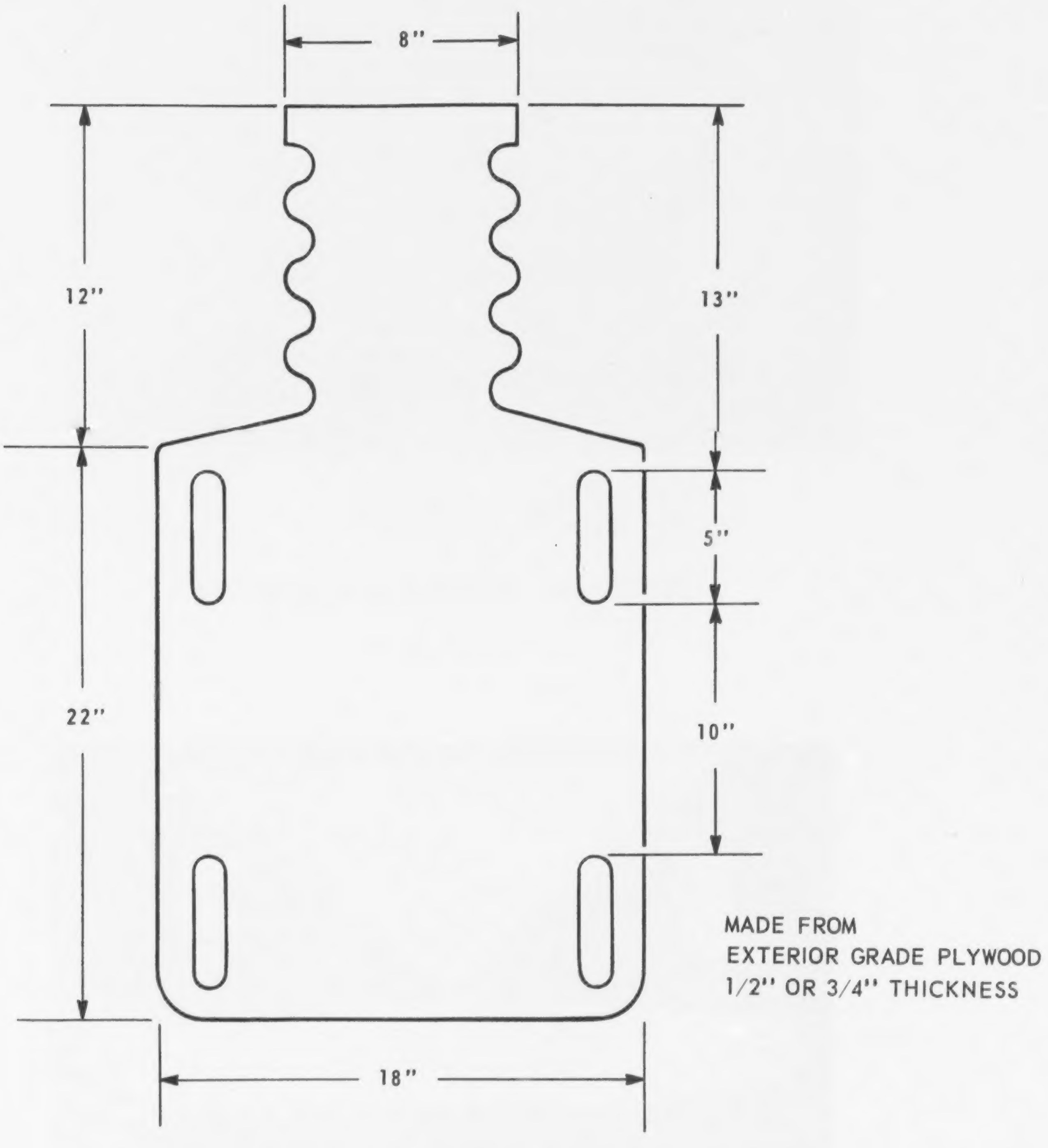
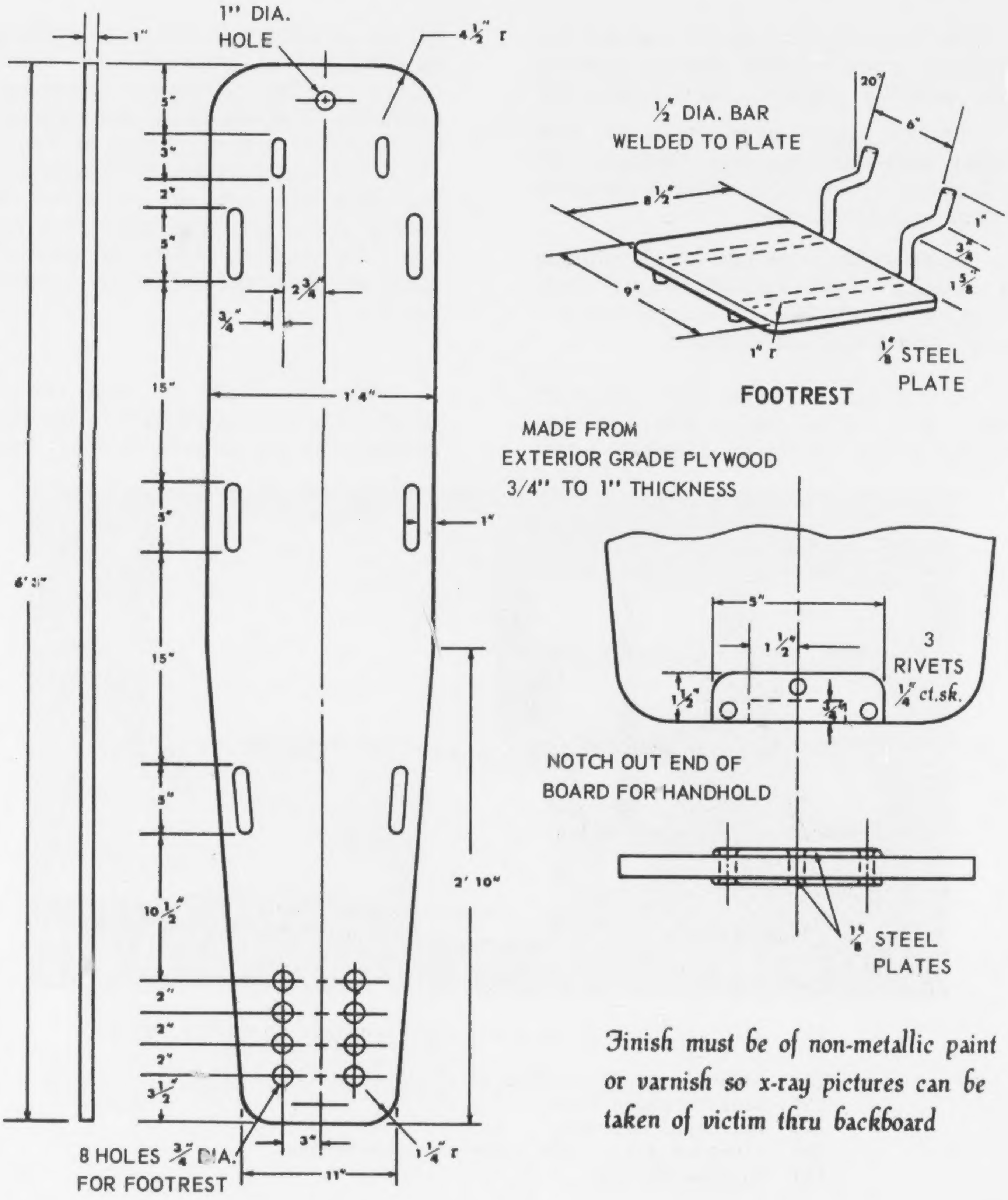

8"
12"
13"
22"
5"
10"
18"
MADE FROM
EXTERIOR GRADE PLYWOOD
1/2" OR 3/4" THICKNESS

FIGURE 11. Short backboard


1"
1" DIA.
HOLE
4½" r
5"
3"
2"
5"
2¾"
¾"
15"
1' 4"
6' 3"
3"
1"
15"
5"
2' 10"
10½"
2"
2"
2"
3½"
3"
1¼" r
11"
8 HOLES ¾" DIA.
FOR FOOTREST
½" DIA. BAR
WELDED TO PLATE
20°
6"
8½"
9"
1"
¾"
1⅝"
1" r
⅛" STEEL
PLATE
FOOTREST
MADE FROM
EXTERIOR GRADE PLYWOOD
3/4" TO 1" THICKNESS
5"
1½"
3
RIVETS
¼" ct.sk.
1½"
¾"
NOTCH OUT END OF
BOARD FOR HANDHOLD
⅛" STEEL
PLATES

Finish must be of non-metallic paint or varnish so x-ray pictures can be taken of victim thru backboard

FIGURE 12. Long backboard

DRESSINGS AND BANDAGES

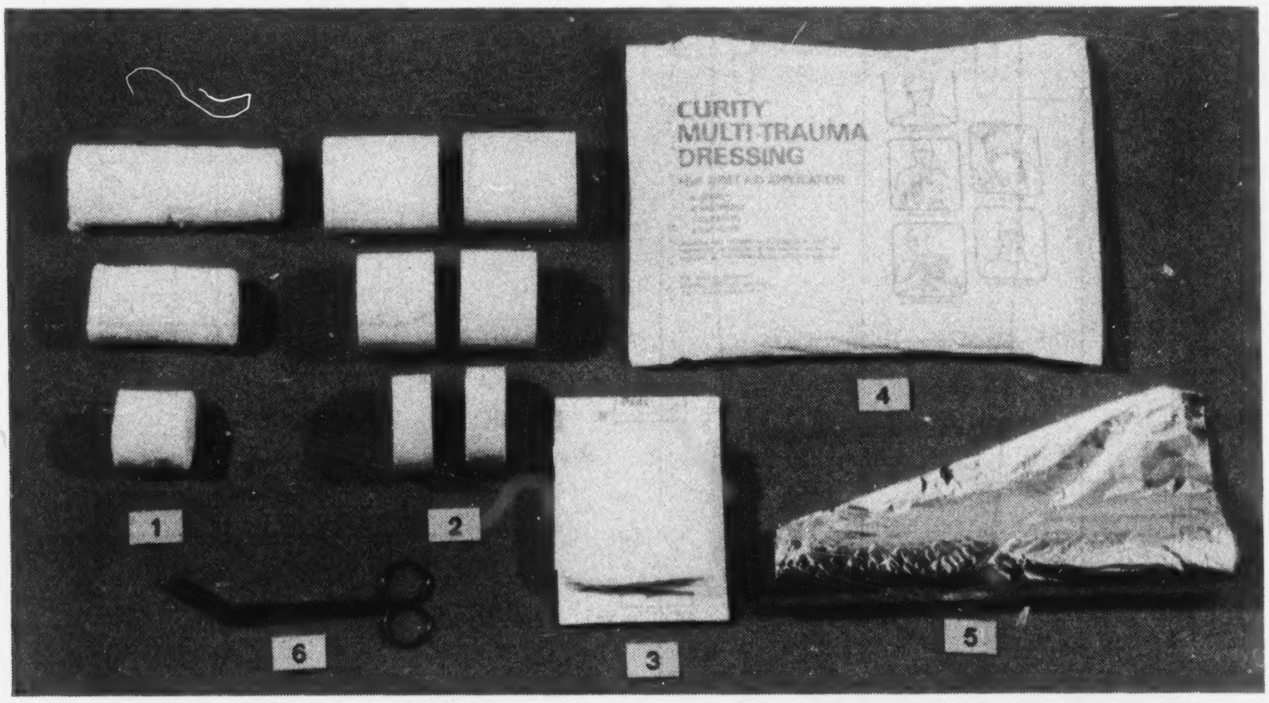
The following are to be carried for dressing open wounds and for padding and applying splints. See Figure 13.

Sterile gauze pads, 4" x 4"; soft roller self-adhering type bandages, 6" x 5 yards required; additional assorted widths may be carried.

Nonporous dressings for the closing of sucking chest wounds can be made from aluminum foil. Carry a roll 18" x 25', sterilized and wrapped.

Universal dressing approximately 10" x 36", folded and packaged in convenient sizes, for covering large wounds, burns, pressure dressings, padding of splints, or to improvise a cervical collar. (The universal dressing is available commercially but can easily be made by cutting bolts of standard "A.B.D." material into 36" lengths, folding from each end to the center three times, and packaging each in a paper bag, the end of which is sealed by stapling. Sterilize and place in a plastic bag.)

Adhesive tape, at least two rolls of 3" wide tape is required. Additional widths may be carried at local option.



(1) Soft roller-self-adhering type bandages in widths of 2"-4"-6"
(2) Adhesive tape - widths of 1"-2"-3"
(3) Sterile gauze pads - 4" x 4"
(4) Universal dressing
(5) Aluminum foil - for non-porous dressings
(6) Bandage shears

FIGURE 13. Dressings and bandages

PREVENTION AND TREATMENT OF SHOCK

Equipment should include sterile intravenous agents, preferably in plastic bags, and sterile disposable intravenous administration sets and injection kits; (see Figure 14.) an aneroid blood-pressure manometer and cuff, and a stethoscope.

The monitoring of blood pressure and the administration of intravenous agents are essential if the victim is to be treated for shock. The techniques can be readily acquired during the in-hospital training. The exact agents to be used and when they should be used will be determined by the local physician.

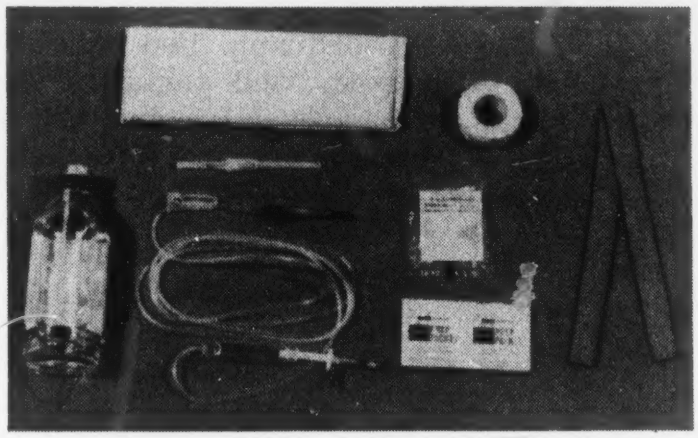
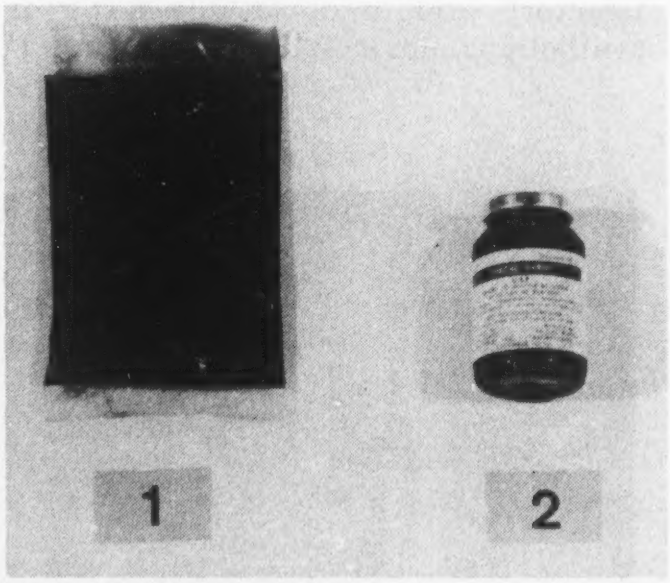


FIGURE 14. Sterile intravenous administration kit

POISON KITS

Those knowledgeable in the field of poisoning control recommend that only Syrup of Ipecac and activated charcoal make up the contents of a poison kit. See Figure 15.

In the conscious victim, emptying the stomach by vomiting is considered the best treatment for poisoning, except when poisoning is due to corrosives or petroleum products.

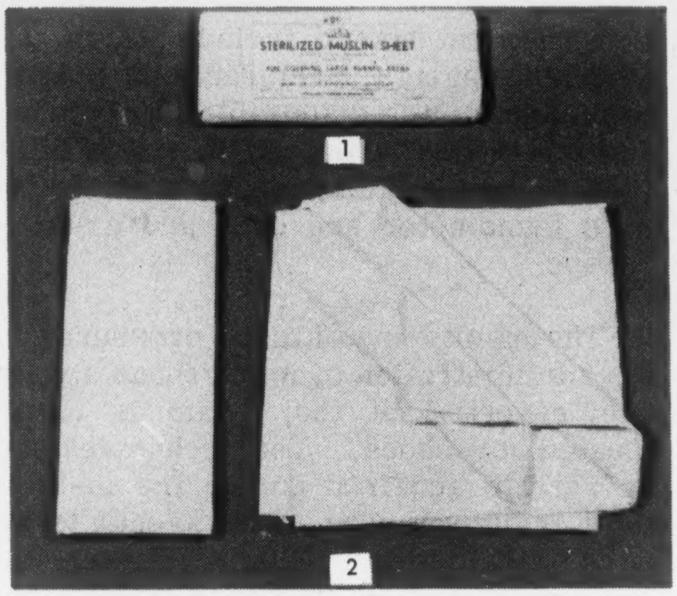


(1) Activated charcoal
(2) Syrup of Ipecac

FIGURE 15. Poison kit

BURN KITS

Commercial burn sheets are available. However, ordinary bed sheets, wrapped, sterilized, and packaged in plastic bags, provide excellent dressings for burns of any size and body location. See Figure 16.



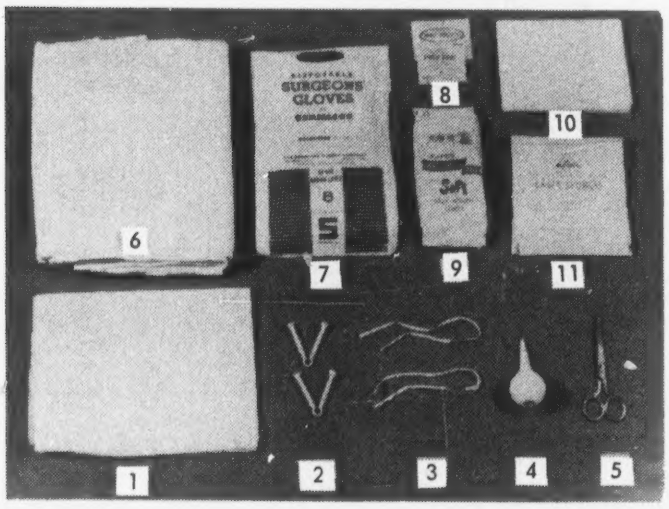
(1) Commercial sterile pack burn sheet
(2) Ordinary bed sheets - folded and sterilized serve as excellent burn sheets

FIGURE 16. Burn kit ➔

STERILE OBSTETRICAL KIT

The O.B. kit should contain as a minimum; sterile gloves, scissors, umbilical cord clamps or tapes, sterile dressings, towels and plastic bags. Satisfactory sterile disposable kits are available commercially. See Figure 17.

Each squad should have available, from hospitals or other sources, a portable incubator that can be secured to the ambulance cot or stretcher for transporting a premature infant. The incubator should permit oxygen enrichment, humidification, temperature control, and access to the infant's head for resuscitation.



(1) Receiving blanket
(2) Cord clamps
(3) Cord ties
(4) Rubber syringe for aspiration
(5) Sterile scissors
(6) Disposable sheets
(7) Sterile rubber gloves
(8) Towelettes for wiping hands of squadman
(9) Sanitary napkin
(10) Disposable towels
(11) Gauze pads

FIGURE 17. Disposable obstetrical kit

STRETCHERS AND COTS

Each vehicle should be equipped with (1) a wheeled ambulance cot, (2) a folding stretcher, (3) a collapsible "stair-chair." Items 2 and 3 may be combined as one folding unit that can be adjusted to either a stretcher or a "stair-chair." The head of the stretcher or cot must be capable of being tilted upward for transport of a victim in the semi-sitting position, and capable of some downward tilt of its entire length (for fluid drainage).

The frame or handles should be designed to permit up to four persons to carry the stretcher and should provide for fasteners to secure it firmly to the floor or side of the vehicle during transport.

(Necessary sheets, pillows, and blankets should be carried, and ideally, an exchange system for such items should be available at the local hospitals.)

SPECIAL EQUIPMENT FOR USE BY PHYSICIAN OR OTHERS TRAINED IN ITS USE

Special equipment should be carried in the vehicle for use by a physician or others trained in its use. This equipment should be stored in sealed containers, and depending on local conditions, decisions may include the following: tracheal intubation kit, pleural (lung sac) decompression set, drug injection kit, venous cut-down kit, tracheostomy kit, urinary catheters, and portable cardioscope and defibrillator.

LIGHT RESCUE EQUIPMENT FOR AMBULANCE

Many times a victim can be rescued or released from entrapment with the use of light equipment. In those cases where heavier rescue equipment must be summoned, the squadmen can gain access to maintain life-support until the heavier equipment arrives and provides total extrication. Remember that the time element in life threatening emergencies is so critical that, if the squadmen must await the arrival of such equipment, lives that could be saved will be lost.

Rescue equipment carried should include:

One wrench, 12 inches, with adjustable open end
One screwdriver, 12 inches, with regular blade
One screwdriver, 12 inches, Phillips type
One hacksaw with 12 wire (carbide) blades
One pliers, 10-inch vise-grip
One 5-pound hammer with 15-inch handle
One fire axe butt with 24-inch handle
One 24-inch wrecking bar or huxbar
One crowbar, 51 inches, with pinch point
One bolt cutter
One portable power jack and spreader tool
One shovel, 49 inches, with pointed blade
One double-action tin snip, minimum, of 8 inches
Two manila ropes, each 50 feet long and 3/4 of an inch in diameter
15-foot rated chain with one grab hook and one running hook

COMMUNICATIONS EQUIPMENT

Equipment for communication by two-way radio is required for direct voice dispatching, routing, notification of hospital emergency departments, direction and assistance from physicians, and cross-communication with fire, police, and other ambulance vehicles.

Portable radios may be provided for communication between squadmen working at a distance from the vehicle.

SAFETY EQUIPMENT

Safeguarding of victims and squad personnel at the scene of an accident or disaster requires equipment to direct and control the conditions that would interfere with the squad's effort to isolate areas, administer care, and to remove the victims from hazardous situations.

This equipment should include: flares, reflectors, and flashlights; at least one 5# dry-chemical "B-C" fire extinguisher; built-in, and portable voice amplification devices; self-contained breathing apparatus as determined by local hazards; and disposable gloves for use in moving body parts, or a deteriorated corpse.

CHAPTER III

PERSONNEL

INTRODUCTION

The successful operation of an emergency or rescue squad unit depends on every man assigned to it. Only when this is recognized and accepted, can satisfaction and efficiency be obtained. The saving of life is a serious business in itself and it should be handled by trained and qualified personnel. A small amount of first aid knowledge is not enough to assure the safety and welfare of a victim, under many circumstances. It should be mandatory that only personnel who have successfully completed the Advanced First Aid Course offered by the American Red Cross, Bureau of Mines, or any other similarly qualified agency, and have passed the state emergency victim care training course, be considered for this important duty.

Good public relations are extremely important in any department. The services of the squad must sell themselves through the conduct and efficiency of individual squadmen. Therefore, it is imperative that squadmen be selected with great care in order that they will obtain respect from the public. Following are more specific recommendations to be used in the selection of personnel.

QUALIFICATIONS

Note: The following items are not listed in any special order of importance. They are to be used comprehensively and collectively and will merely serve as a guide to determine the over-all capability of each person to be considered as a squadman.

1. He must have volunteered for the job. This is primarily an indication that the person wants to take part in the performance of this particular duty at his own request. As a rule, no one cares to do a job, or carry out the duties of a job, if he has a physical or mental aversion to the obligation involved.

2. He must be available. There is no point in having a man assigned to life-saving units when it may be questionable as to whether he will, or will not be in a position to respond to the alarm. For example, a man whose private work takes him out of the community would not be a good choice. However, if there are a number of men involved in the same situation, it might be well to give some thought to the idea of organizing the personnel on a so-called day or night platoon basis. Thus squad personnel would be available on a round-the-clock basis.

3. He must be dependable. Dependability is of the utmost importance. This virtue gives assurance that the squadman will carry out assignments to the best of his ability.

4. He must have a good reputation. A person's good name and standing in

public esteem must definitely fit into the analysis. This type of public work will present many delicate situations, especially when the confidence of the victim in his benefactor is sorely needed. (In short, is he a good citizen?)

5. He must present a good appearance. A slovenly, dirty and unkempt individual will immediately cause the victim, as well as the general public, to look with disfavor on his benefactor. Even a stranger, when carefully groomed, is an asset when dealing with others. Many emergency and rescue units have a type of white shop coat available to their squadmen. Such a coat is easily donned and gives the men that look of neatness and cleanliness which is always so desirable.

6. He must have a pleasant personality. Arrogance and superiority will be quickly resented. Courtesy and understanding will always open the door for a better relationship with the victim. The public will also react and cooperate more favorably when treated in a firm but courteous manner.

7. He must be cooperative. This is a characteristic which calls on a person's ability to harmonize, pull together, work shoulder to shoulder, and go along with others. It may be said that people do not think together, but under emergency situations, they should act together. There is no time for bickering at the scene of an emergency. Orders and methods must be carried out even if they are not to individual liking. As a rule the end result is the same.

8. He must be definitely interested in the job. This is fundamentally a specialized field. Consequently, there will always be new and different approaches, techniques and procedures offered on the subject. If the enthusiasm is there to learn, study, and keep abreast of the times, such an individual will definitely be an asset to the squad. Then again, it must be realized that each person's interests are different. There are many firemen who are happy just to be good firemen because they love firefighting. On the other hand, the same answer is also applicable to squadmen. Personnel once placed on emergency units often make it their life's work. Whichever job it may be, however, the deciding factor is controlled by the man's interest in the job at hand.

9. He must have initiative. The ability of a person to determine for himself what has to be done, and then having the capability of going ahead and doing it, is an important qualification in this line of work. The necessity to deal with unusual situations, conditions and circumstances, makes it imperative that squad and emergency personnel have this qualification.

10. He must be cool, level-headed and have the ability to exercise common sense. Emergency situations call upon the individual to use these qualities because of the turmoil which exists during the time of an emergency. The situation, when handled wisely and properly, will make matters easier for everyone concerned.

11. He must have an aptitude for training. The study and training time involved in learning to be a good squadman is in substance not a long-term indoctrination of practice and knowledge. First aid and life saving courses are outlines to supply the utmost in information and training in a practical and reasonable length of time. Therefore, the ability to learn quickly and have natural talent to apply this training is an important factor in personnel selection.

12. He must have leadership ability. "As ye lead, so shall they follow", may be a safe axiom in this case. These emergency situations always call for an immediate show of authority and command. When used wisely, this quality will make it easier to control the emergency.

13. He must be in good health and physical condition. One never knows, when responding to an emergency alarm, exactly what is involved. A man may be called upon to climb, run, dig, pull, push, etc. Therefore, it is very important that a selectee have the normal good health and recognized physical abilities to perform his duties in a manner that is not detrimental to victim, his fellow squadmen, or himself.

COMPLEMENT OF EMERGENCY AMBULANCE UNITS

A minimum of three squadmen should be assigned to respond to every emergency. This number should include an officer or a man in charge. However, due to a manpower situation, a response may include only two men. If such is the case, the squadmen will, on many occasions, request assistance from the family or bystanders to lift, carry, etc. Under no conditions should a squad be dispatched with less than two men.

Courtesy Minerva Park Emergency Squad, Columbus, Ohio

Courtesy Minerva Park Emergency Squad, Columbus, Ohio

Many emergency squads in the suburban areas are using women to staff their operations. Pictured is a "squaw squad" that operates entirely with women who provide excellent emergency care.

FIGURE 1

FIGURE 2

CHAPTER IV

OPERATIONS

INTRODUCTION

It is advisable to incorporate an efficient and practical method of alerting emergency squad units. The nature of this particular operation certainly calls for a somewhat different approach than the customary notification to signify an alarm of fire.

ALERTING SYSTEM

Our goal can be achieved by keeping several factors in mind: namely (1) The emergency must be identified so that both fire-fighting and emergency personnel will immediately recognize its nature; (2) Reponse must be rapid, only by the personnel assigned to the rescue units; (3) Unnecessary confusion and disorder which delay response to this type of alarm must be avoided.

As a rule, in paid departments these problems are circumvented by having a coded alarm system on their firehouse bell. By merely changing the number of rings, the personnel can immediately ascertain the type of alarm, and report to the apparatus floor accordingly. The problem is not that simple in volunteer fire departments. In some cases, a siren mounted on the top of the fire station or on a nearby pole is the only type of general alarm which can be given. These are set in action by telephones, relays, or manual controls. A series of wails is emitted which signifies the alarm of fire or emergency. If, however, these wails can be controlled to definitely distinguish a difference in the nature of the alarm, our purpose is accomplished. This problem should be discussed with local agencies involved in the installation of the alerting system to determine whether or not this is possible.

An alerting system that is used by many squads today employs a transmitter and individual home receivers. A receiver is placed in the home of each squad member.

The transmitter is located where the squad alarms are received. The dispatcher can immediately transmit a particular tone that opens all home receivers. The dispatcher can then alert the squad members as to the location and type of emergency.

There are many types and styles of notification systems now in operation. We recommend that a study be made of the situation from the standpoint of local needs, conditions, and circumstances. Expert advice and information will be offered by representatives of the various firms in this field.

Regardless of the kind of system which is finally selected, it is deemed advisable to give additional thought to establishing a "stand-by" routine for alarms involving the emergency and rescue squad units. Thus, a call from the squadmen at the scene for additional equipment, apparatus, doctors, nurses, etc., can be expedited immediately, instead of going through the entire alarm routine a second time.

RESPONSE

The main concern here is to facilitate an efficient and orderly "all out" by the personnel assigned to the emergency squad. There is no point in cluttering highways and adding confusion to local traffic with excess private vehicles trying to reach the scene, or the apparatus headquarters. If only the members assigned to these units respond, it is apparent that many of these problems will be eliminated. In addition, valuable seconds will be saved, thus enabling the apparatus to leave the station more quickly. There is bound to be a greater degree of delay when waiting for a larger complement of personnel to arrive for duty.

Here, again, the possible need is for response by the "stand-by" or extra men assigned to these units. Their availability at headquarters in the event of additional calls on the same alarm will aid tremendously in expediting efficiently any type of emergency service.

COMMUNICATIONS

It is recommended that an adequate communication system be incorporated in the over-all operation of emergency squad units. In many instances, when arriving at the scene, it is necessary to call back for additional equipment and personnel, contact the sheriff's office, call the State Highway Patrol, hospital, etc. When this can be done directly from the unit, valuable time can be saved by squadmen. Furthermore, there is nothing more discouraging or inopportune, especially when in the public eye, than a situation in which men and equipment stand by helplessly because circumstances demand additional apparatus or manpower, and nothing can be done about getting it there. Modern emergency squads utilize two-way radio communications to a great advantage.

Ideally the communication system should include direct two-way voice contact with the base station, the vehicle, and the hospital. This will insure:

1. Prompt dispatch of the squad to the scene.

2. Control routing as necessary due to traffic conditions.

3. Response of heavy rescue equipment, additional manpower and supplies.

4. Advice from hospital to squad on care of victims at the scene and during transport.

5. Notification directly to hospital on the arrival, condition, and number of victims.

6. The distribution of victims to other medical facilities.

7. The cooperation and coordination with law enforcement agencies.

8. Mutual assistance with other squads.

All squadmen should be thoroughly trained in the use of their communication equipment. Compliance with all Federal Communications Commission regulations and limitations is mandatory.

CODING CALLS

It is a good practice to code most information transmitted over a two-way radio. This is especially true when the condition of the patient is involved. For example, if the patient's condition is critical this fact might be communicated over the radio as "code signal 95." If the patient were to hear the squadmen state his condition was critical, it might cause his shock to become more severe.

Additional code signals can be used for many other patient conditions. These coded messages might include:

1. Have hospital prepare oxygen
2. An O.B. case
3. Condition fair
4. Condition good
5. Condition critical
6. Severe bleeding, uncontrolled

Using this type of coding, the squad can notify the dispatcher, or they can call the hospital to be prepared. This procedure will result in better reception of the patient at the hospital. See figure 1.

It must be emphasized that alerting the hospital should be according to the established local policy. Some hospitals wish to be notified of all arrivals, others only want notification of victims with life-threatening emergencies.

Code

1 - Call Sheriff
2 - Accident Property Damage
4 - Accident Injury
5 - Call Station (phone)
6 - Aircraft Crash
9 - Investigate Smoke
12 - Fall
13 - Gunshot
14 - Vehicle
15 - Explosion
16 - Dead on Arrival
22 - Drowning
25 - Returning to HQD.
27 - Emergency Run
28 - Fire (Give Location)
29 - Ambulance Requested
31 - Wrecker Requested
32 - Homicide
33 - In Service
37 - Out of Service
39 - Your Location
43 - Your Residence
49 - Radio Repair
53 - Fire Under Control
55 - Civil Defense Alert
57 - Call Cancelled
58 - Suicide

Signal

71 - Bleeding
72 - Burn
73 - Convulsion
74 - Coronary
75 - Crushed
76 - Cut
77 - Fatal Accident
78 - Difficulty in Breathing
79 - Fracture
80 - Miscarriage
81 - Multiple Injuries
82 - Nerves
83 - O. B.
84 - Overdose of Medicine
85 - Repair or Fuel
86 - Pain
87 - Poison
88 - Mutual Aid Requested
89 - Puncture
90 - Stroke
91 - Vaginal Bleeding

Area of the Body

A - Head
B - Mouth
C - Eye
D - Ear
E - Neck
F - Back
G - Chest
H - Stomach
J - Abdomen
K - Arm
L - Hand
M - Leg
N - Thigh
P - Knee
R - Ankle
S - Foot

FIGURE 1. Examples of codes and signals to be used in radio transmission and other voice communications.

CHAPTER V

RECORDS AND REPORTS

INTRODUCTION

Proper reporting and record keeping are extremely important in the operation of an emergency squad. This chapter discusses important items of information that should be included on reports for successful operation and future reference. Sections of a run report sheet are shown one at a time, and important items are discussed. Each section extends across both columns with the explanatory text running consecutively from column to column. The complete report form is shown on page 37, together with several other sample run reports and a typical monthly summary report. (Figures 1 through 6.)

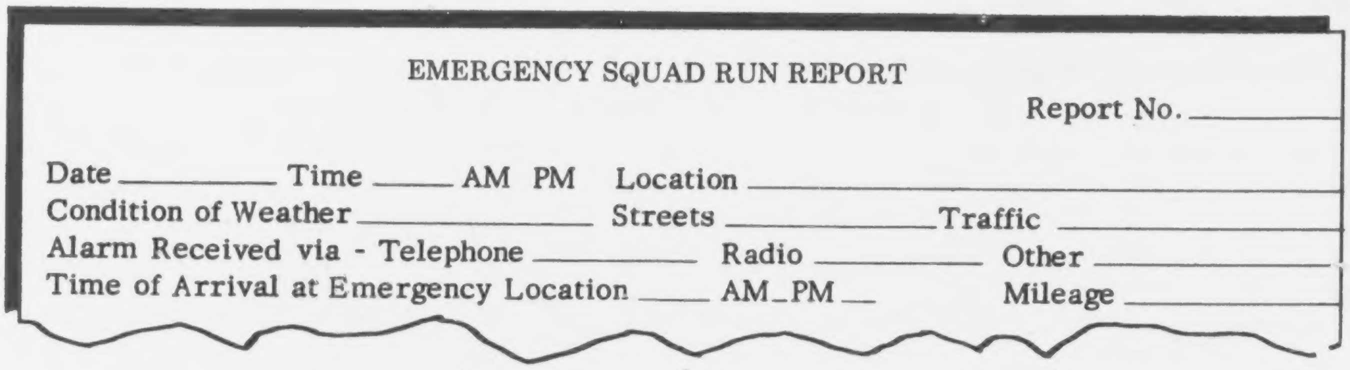
RESPONSIBILITY FOR REPORTS

The responsibility for reports is determined by local authority, such as the squad chief, fire chief, or ambulance supervisor. It is his duty to designate who is responsible for making the report.

IMPORTANT ITEMS ON SQUAD REPORTS

RECEIVING AND RESPONDING TO ALARM

The date, time of receiving alarm, and location should be placed at or near the top of the report. Many squad reports provide a place to record "How the Alarm Was Received", that is, by telephone, messenger, police, radio, alarm system, etc. Some squad run reports include "Time of Arrival at Emergency Location" and "Mileage".



EMERGENCY SQUAD RUN REPORT

Report No. ______

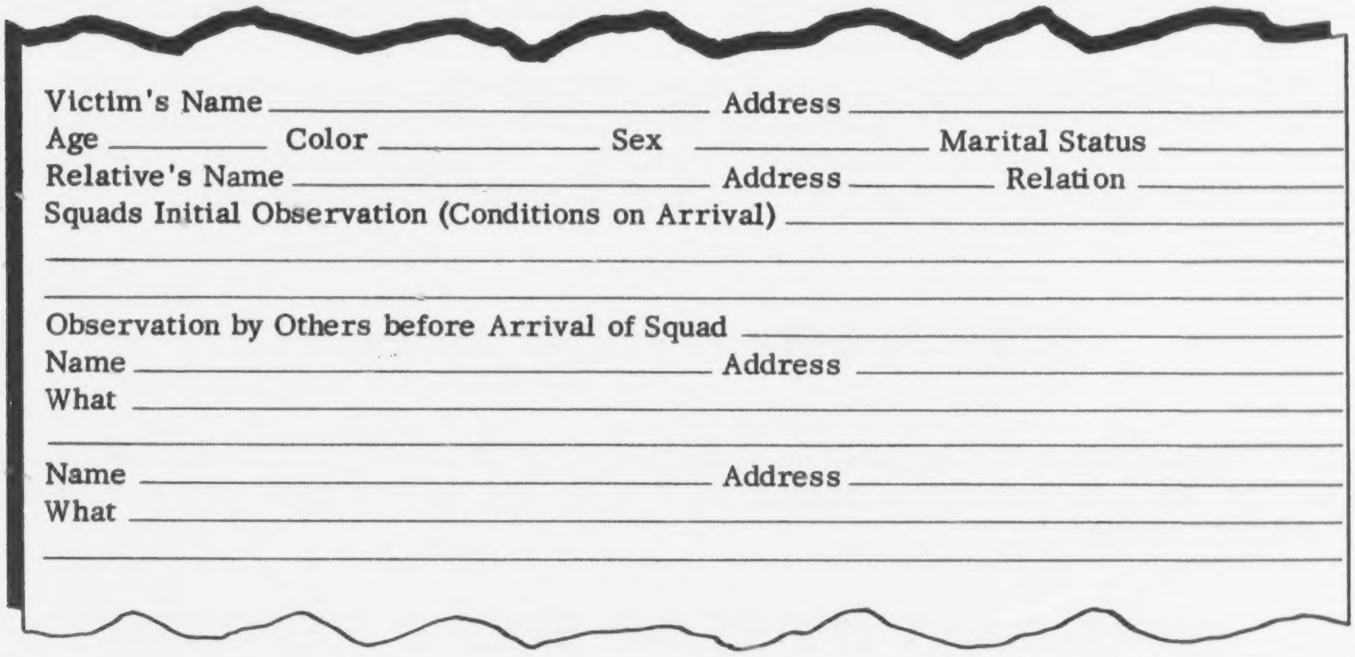
Date ______ Time ______ AM PM Location ______
Condition of Weather ______ Streets ______ Traffic ______
Alarm Received via - Telephone ______ Radio ______ Other ______
Time of Arrival at Emergency Location ______ AM_PM __ Mileage ______

OBSERVING THE CONDITION OF A VICTIM WHEN FOUND

Space should be provided for the name and address of the victim, plus a brief but complete explanation of the squadman's initial observation of the situation.

Space should also be provided to record the names and addresses and important information received from persons who were at the scene before the squad's arrival.

On many report forms the back of the sheet is blank, allowing ample room to include additional information. If data are recorded on a separate sheet of paper, it should be securely attached to the report form for reference.



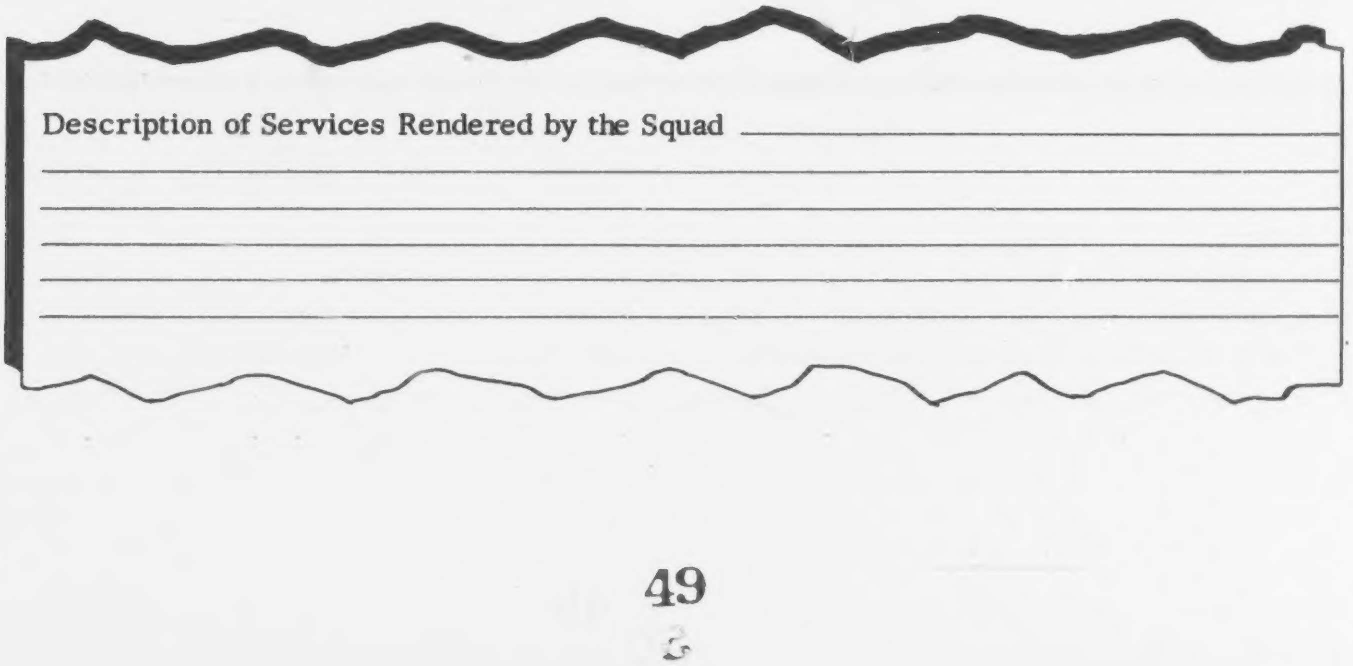
Victim's Name ______ Address ______
Age ______ Color ______ Sex ______ Marital Status ______
Relative's Name ______ Address ______ Relation ______
Squads Initial Observation (Conditions on Arrival) ______

Observation by Others before Arrival of Squad ______
Name ______ Address ______
What ______

Name ______ Address ______
What ______

EMERGENCY CARE GIVEN BY THE SQUAD

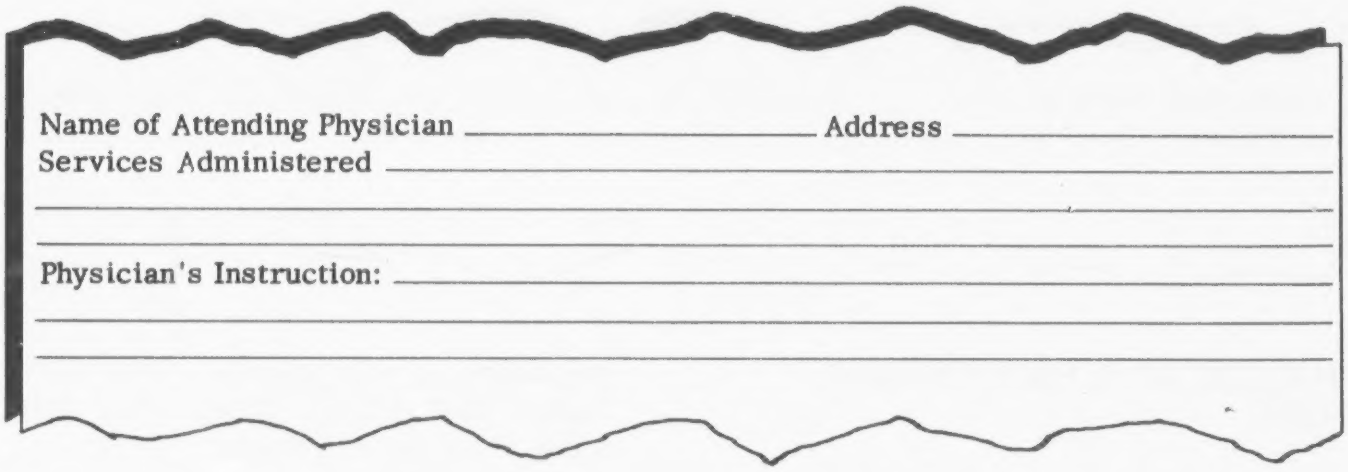
A description of the emergency care and other important services given by the squad should be included on the report. Here too, the reverse side of the report or a separate sheet of paper may be used.



Description of Services Rendered by the Squad ______

MEDICAL SERVICES PROVIDED BY A PHYSICIAN AT THE SCENE

This information should be requested from the attending physician and be entered on the report. Space should be provided for the attending physician's name and address, the services he provided, and his instructions or suggestions either to the squad or to hospital personnel. Presenting a scratch pad with pencil to the physician at an appropriate time may assist a squadman to obtain this information.

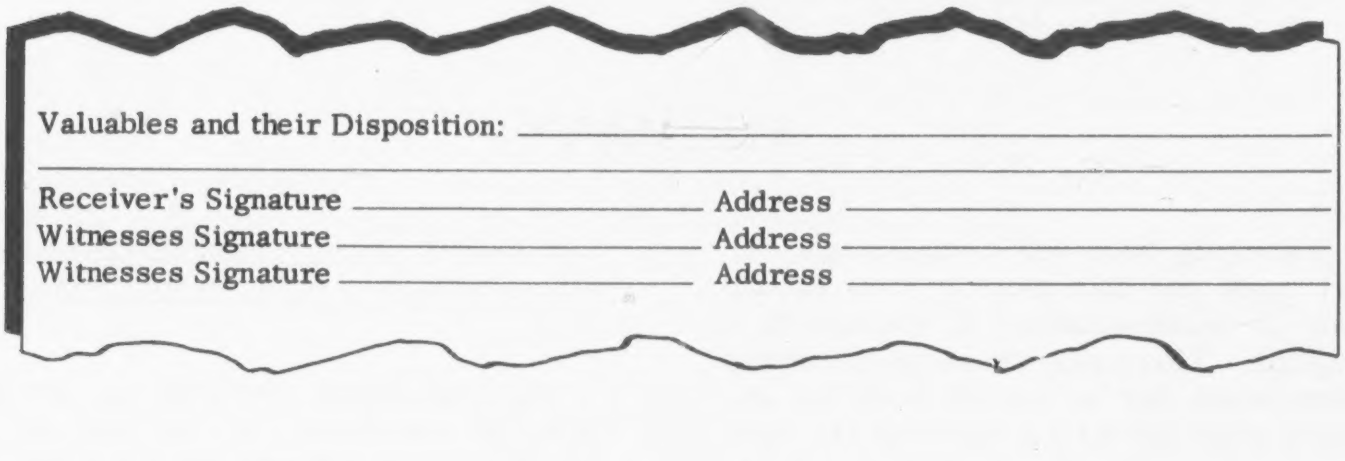


Name of Attending Physician ______________ Address ______________
Services Administered ______________
____
____
Physician's Instruction: ______________
____
____

HANDLING OF VALUABLES

Proper handling of valuables at an emergency is extremely important, and all personal items should be treated as valuable. An item which has little monetary value may be regarded by someone as extremely valuable because it is a gift or keepsake.

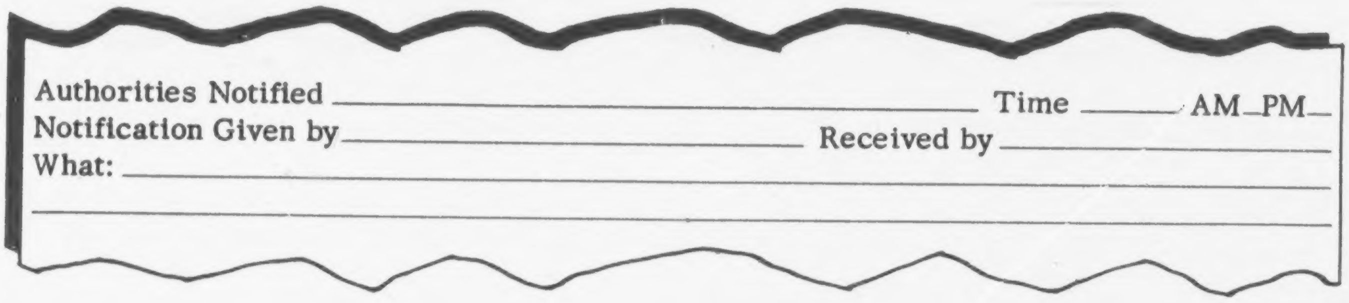
It is very important to make out an itemized list, properly signed and witnessed, when valuables are put in the trust of a squadman or others. Usually valuables are not taken from victims who are conscious. (Usually this is left up to the police or hospital.



Valuables and their Disposition: ______________
____
Receiver's Signature ______________ Address ______________
Witnesses Signature ______________ Address ______________
Witnesses Signature ______________ Address ______________

NOTIFYING PROPER AUTHORITIES

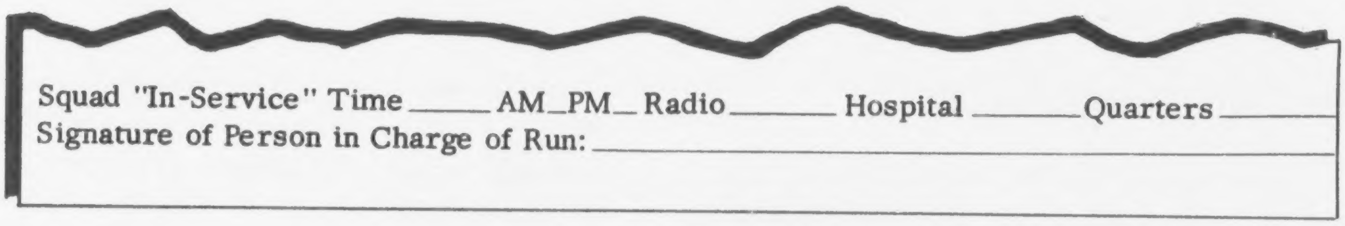
In some situations squadmen may be required to notify the coroner, a police agency, or the state fire marshal's office. In this case the name and title of the person receiving the information should be requested and made a part of the report, along with the hour of the day when he was notified. Sometimes the dispatcher obtains this information, rather than the squadman at the scene. Whatever action is taken, it must conform with the local, state, and federal laws.



Authorities Notified ________________ Time ______ AM__PM__
Notification Given by ________________ Received by ________________
What: ____
____

SIGNATURE OF PERSON MAKING REPORT

No report is complete without the signature of the person who made it. Local department rules may require more than one signature.



Squad "In-Service" Time ______ AM__PM__ Radio ______ Hospital ______ Quarters ______
Signature of Person in Charge of Run: ____

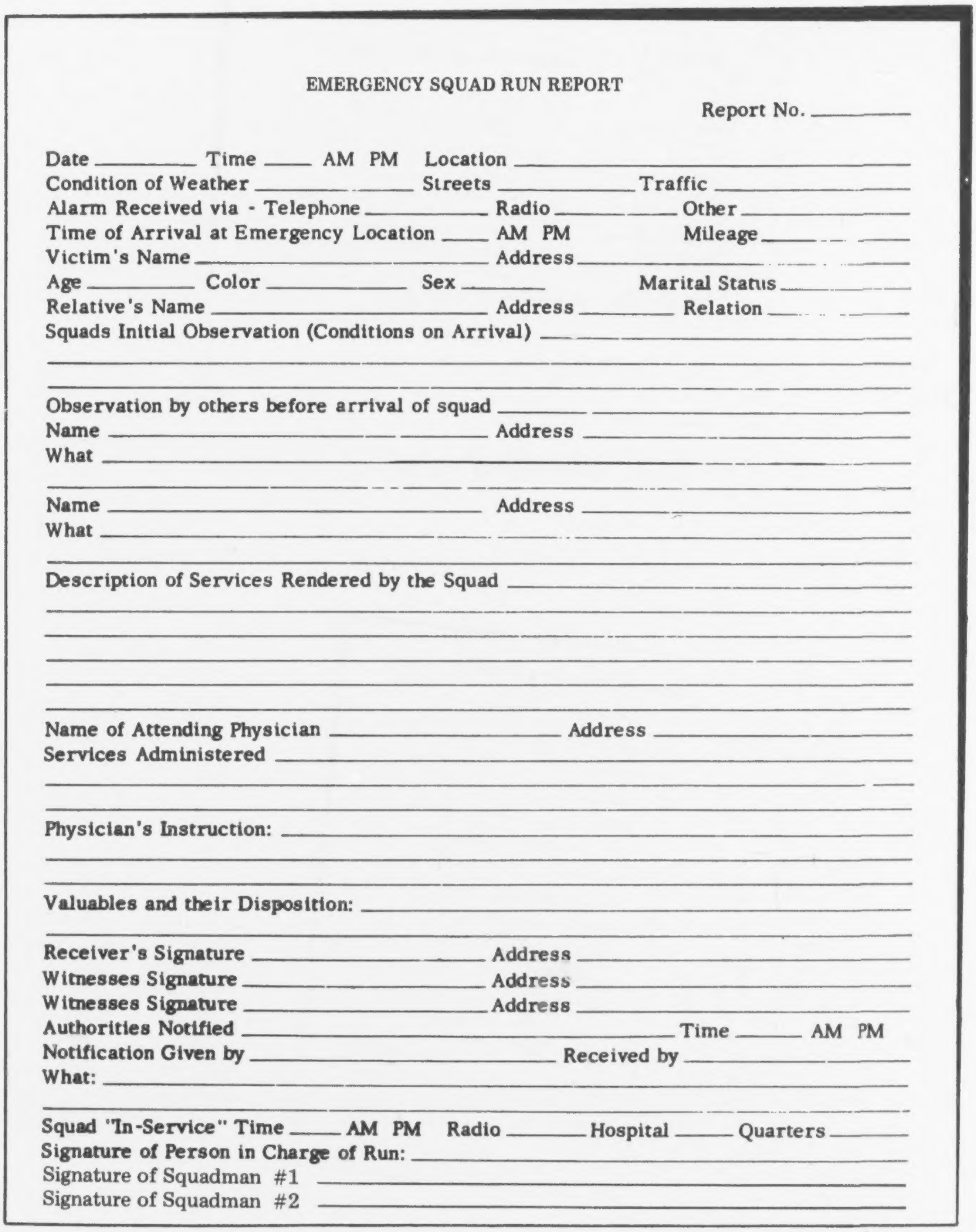
SAMPLE REPORTS

Several sample reports are shown here to assist rescue squad officers in selecting or developing a report best suited to their needs. Some of these samples ask for additional kinds of information, which various squads have found to be helpful.

SUMMARY

Gathering data and completing a report must not take priority over victim care or transportation of victims to a hospital. There may be occasions when information for a report must be obtained after the victim has been removed from the scene. The need for accurate and complete reports should never be minimized; however, reports must never take precedence over victim care.

Rescue squad records can be subpoenaed into court. A complete and accurate report reflects the efficiency and professional competence of the squad.



EMERGENCY SQUAD RUN REPORT

Report No. ____

Date ____ Time ____ AM PM Location ____
Condition of Weather ____ Streets ____ Traffic ____
Alarm Received via - Telephone ____ Radio ____ Other ____
Time of Arrival at Emergency Location ____ AM PM Mileage ____
Victim's Name ____ Address ____
Age ____ Color ____ Sex ____ Marital Status ____
Relative's Name ____ Address ____ Relation ____
Squads Initial Observation (Conditions on Arrival) ____

Observation by others before arrival of squad ____
Name ____ Address ____
What ____

Name ____ Address ____
What ____

Description of Services Rendered by the Squad ____

Name of Attending Physician ____ Address ____
Services Administered ____

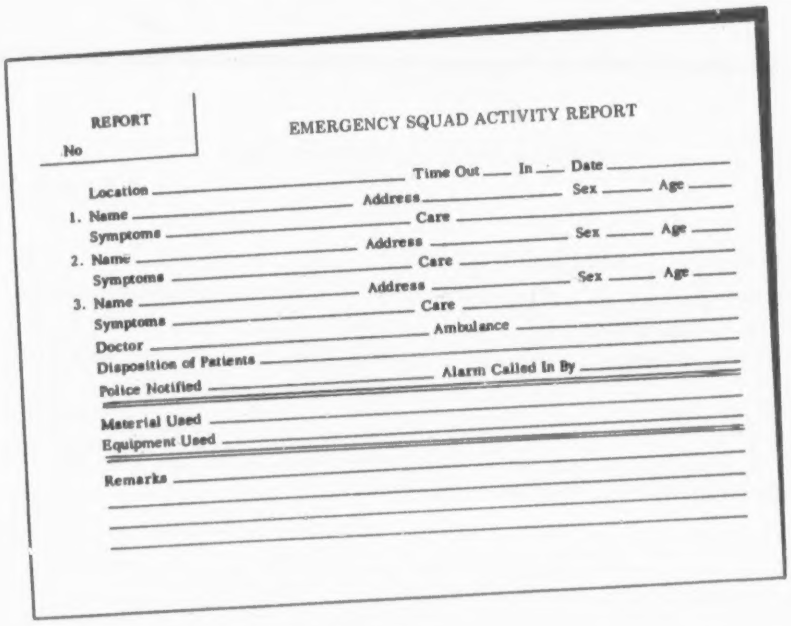
Physician's Instruction: ____

Valuables and their Disposition: ____

Receiver's Signature ____ Address ____
Witnesses Signature ____ Address ____
Witnesses Signature ____ Address ____
Authorities Notified ____ Time ____ AM PM
Notification Given by ____ Received by ____
What: ____

Squad "In-Service" Time ____ AM PM Radio ____ Hospital ____ Quarters ____
Signature of Person in Charge of Run: ____
Signature of Squadman #1 ____
Signature of Squadman #2 ____

FIGURE 1. Emergency squad run report

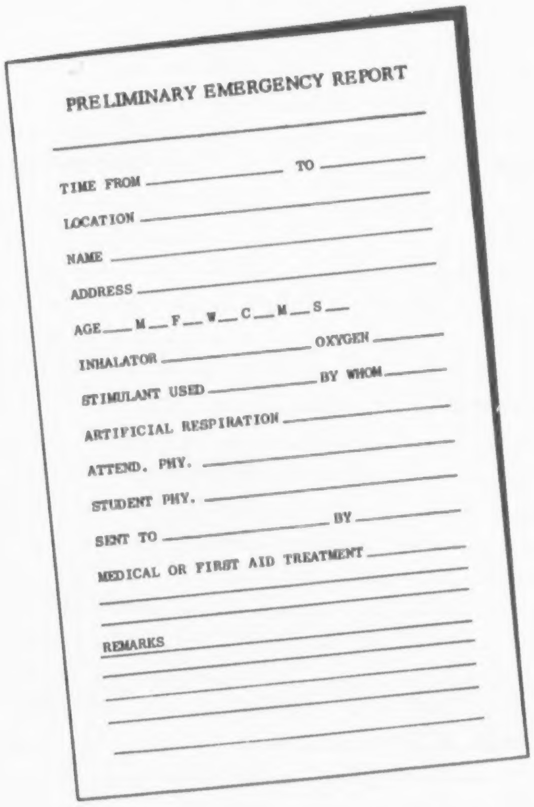


REPORT
No

EMERGENCY SQUAD ACTIVITY REPORT

Time Out ____ In ____ Date ____
Location ____ Sex ____ Age ____
Address ____
1. Name ____ Care ____
Symptoms ____ Sex ____ Age ____
Address ____
2. Name ____ Care ____
Symptoms ____ Sex ____ Age ____
Address ____
3. Name ____ Care ____
Symptoms ____ Ambulance ____
Doctor ____
Disposition of Patients ____
Police Notified ____ Alarm Called In By ____
Material Used ____
Equipment Used ____
Remarks ____

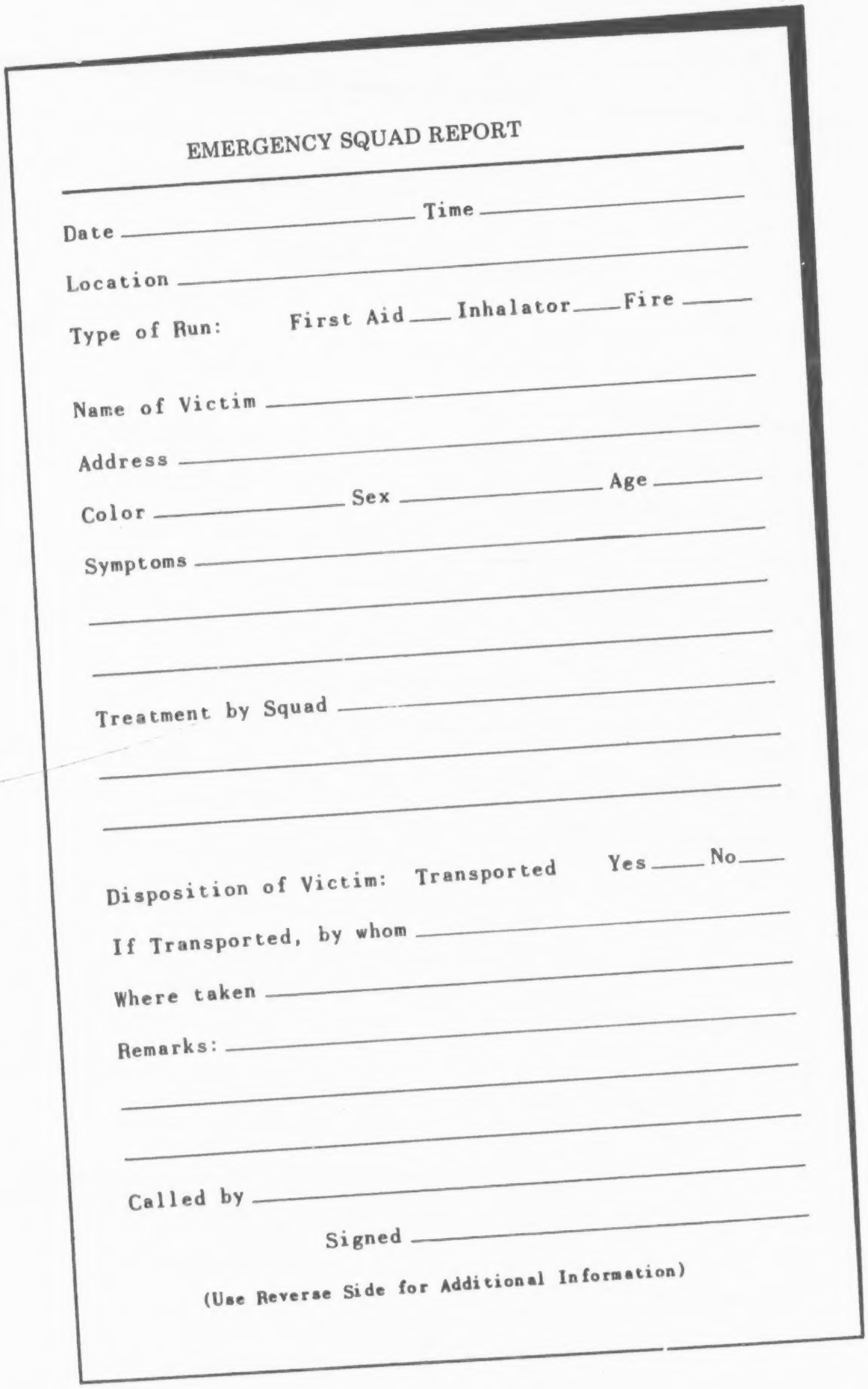
FIGURE 2. Emergency squad activity report



PRELIMINARY EMERGENCY REPORT

TIME FROM ____ TO ____
LOCATION ____
NAME ____
ADDRESS ____
AGE ____ M ____ F ____ W ____ C ____ M ____ S ____
INHALATOR ____ OXYGEN ____
STIMULANT USED ____ BY WHOM ____
ARTIFICIAL RESPIRATION ____
ATTEND. PHY. ____
STUDENT PHY. ____
SENT TO ____ BY ____
MEDICAL OR FIRST AID TREATMENT ____
REMARKS ____

FIGURE 3. Preliminary emergency report



EMERGENCY SQUAD REPORT

Date ____________ Time ____________

Location ____________

Type of Run: First Aid ___ Inhalator ___ Fire ___

Name of Victim ____________

Address ____________

Color ________ Sex ________ Age ________

Symptoms ____________

____

____

Treatment by Squad ____________

____

____

Disposition of Victim: Transported Yes ___ No ___

If Transported, by whom ____________

Where taken ____________

Remarks: ____________

____

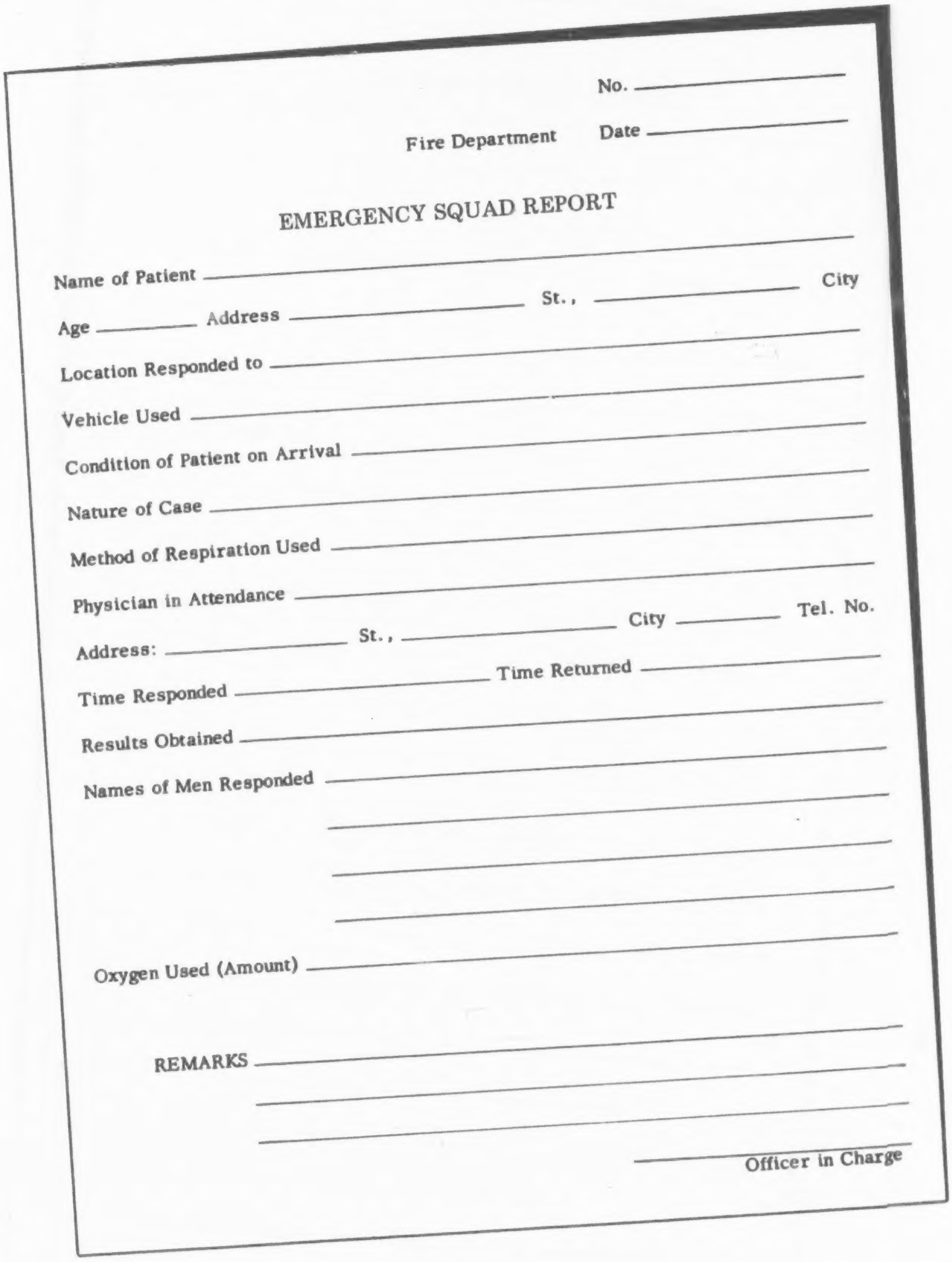
____

Called by ____________

Signed ____________

(Use Reverse Side for Additional Information)

FIGURE 4. Emergency squad report



No. ______

Fire Department Date ______

EMERGENCY SQUAD REPORT

Name of Patient ______

Age ______ Address ______ St., ______ City

Location Responded to ______

Vehicle Used ______

Condition of Patient on Arrival ______

Nature of Case ______

Method of Respiration Used ______

Physician in Attendance ______

Address: ______ St., ______ City ______ Tel. No.

Time Responded ______ Time Returned ______

Results Obtained ______

Names of Men Responded ______

Oxygen Used (Amount) ______

REMARKS ______

______ Officer in Charge

FIGURE 5. Emergency squad report

MONTHLY EMERGENCY SQUAD SUMMARY

RESCUE UNIT NO.________ FOR THE MONTH OF________________ 19____

NO.	DATE	ALARMS		SQUAD NO.	WORKING TIME		LOCATION	NATURE OF EMERGENCY	DISPOSITION
		TEL	RAD		HRS.	MIN.			
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
							TOTALS		

MILEAGE ________ MILES GASOLINE ________ GALS.

____
OFFICER IN CHARGE

FIGURE 6. Monthly emergency squad summary

EMERGENCY SQUAD
RUN REPORT

CONTROL NO.____________

DATE____________ TIME OF ALERT____________ SQUAD UNIT NO. ____________

Name of victim ________________________________

Address of victim ________________________ Phone No.____________

1 TYPE OF INJURIES OR ILLNESS	1 ☐ Dry Run 2 ☐ Head 3 ☐ Face 4 ☐ Eye 5 ☐ Neck 6 ☐ Back 7 ☐ Chest 8 ☐ Abdomen	9 ☐ Pelvis 10 ☐ Upper Extremity 11 ☐ Lower Extremity 12 ☐ General, Multiple 13 ☐ Respiratory 14 ☐ Cardio Vascular 15 ☐ Electrocution 16 ☐ Fainting	17 ☐ Maternity 18 ☐ Psychiatric 19 ☐ Alcoholism 20 ☐ Burn 21 ☐ Poisoning 22 ☐ Drowning 23 ☐ Suffocation 24 ☐ Other ____________	6 CASE SEVERITY SCALE ☐ 1 Minor, Trivial
2 STATE OF INJURED	1 ☐ Unconscious	2 ☐ Obviously Alive	3 ☐ Possibly Dead on Arrival at Scene	
3 AID PROVIDED BEFORE RESCUE UNIT ARRIVED	NONE ☐ Helpful ☐ 1 Harmful ☐ 2 Neither ☐ 3	1 ☐ Artificial Respiration 2 ☐ Controlled Bleeding 3 ☐ Splinting 4 ☐ Removed from Vehicle 5 ☐ Other ____________	BY WHOM 1 ☐ Police 2 ☐ Other	☐ 2 Moderate
4 AID PROVIDED BY RESCUE UNIT CREW	NONE ☐	1 ☐ Airway Cleared 2 ☐ Artificial Resp. 3 ☐ Resuscitator 4 ☐ Airway Tube 5 ☐ Oxygen 6 ☐ Cardiac Massage 7 ☐ Controlled Bleeding 8 ☐ Bandaging 9 ☐ Anti-Shock Measures	10 ☐ Spinal Immobilization 11 ☐ Limb Splints 12 ☐ Pain Relief 13 ☐ I.V. Fluids 14 ☐ EKG 15 ☐ Defibrillation 16 ☐ Patient Restraints 17 ☐ Obstetrical Delivery 18 ☐ Other ____________	☐ 3 Severe
5 WHAT WAS LACKING?	1 ☐ Special EQUIPMENT for ____________ 2 ☐ Special TRAINING in ____________ 3 ☐ FASTER Method of Transportation 4 ☐ Nothing 5 ☐ Don't Know			☐ 4 Critical

FIGURE 7A. Emergency squad run report (front side)

7 Use of Lights & Siren	To Scene Yes ☐ No ☐ To ER Yes ☐ No ☐
8 DIFFICULTIES ENCOUNTERED EN ROUTE	NONE ☐ To Scene / To ER Severe Traffic Congestion ☐1 ☐1 Adverse Weather Conditions ☐2 ☐2 Mechanical Trouble ☐3 ☐3 Other ______ (Specify) ☐4 ☐4
9 LOCATION OF PICKUP	Street Address or Highway Route and Nearest Intersection ______ ______
10 REMARKS: Enter here names and addresses of additional patients if more than one. Enter remarks you feel necessary that are not covered above.	
11 NAMES OF SQUAD CREW: ______ ______	

FIGURE 7B. Emergency squad run report (reverse side)

CONTROL NO. ______

EMERGENCY ROOM CHECK SHEET

______ Name of Injured Person

______ Name of Hospital

☐☐☐ Date of Accident

☐☐☐ Date of Admission (if different)

1 **TIMES:**

ER ARRIVAL Time ☐ AM ☐ PM ☐

Seen by PHYSICIAN at ☐ AM ☐ PM ☐

DEPARTED ER at ☐ AM ☐ PM ☐

2 **TO**

1 ☐ Home

2 ☐ Surgery

3 ☐ Hospital

4 ☐ Transfer to ANOTHER Hospital

______ (Name)

5 ☐ Jail

6 ☐ Mortuary

7 ☐ Morgue

8 ☐ Other______

______

3 ARRIVED FROM 1 ☐ Home 2 ☐ Scene of Accident 3 ☐ Other Hospital ______ Name 4 ☐ Other

4 ☐ CONSCIOUS ☐ STUPOROUS ☐ UNCONSCIOUS	5 AMBULATORY ☐ Yes ☐ No	6 SHOCK ☐ Yes ☐ No	7 Any Evidence of ALCOHOL ☐ Yes ☐ No	8 AGE	9 ☐ Male ☐ Female

10 Primary Admitting Diagnosis ______

______

______

11 **MAJOR INJURIES**

Type of Injury

	Code
Pain	1
Contusions or abrasions	2
Lacerations	3
Possible sprain or strain	4
Possible fracture or dislocation	5
Possible internal soft-tissue injury	6

Code Type	Code Site

(List type and site pairs in decreasing order of significance)

Site of Injury

Code	
A	Head
B	Face
C	Eye
D	Neck
E	Back
F	Chest
G	Abdomen
H	Pelvis
W	Upper Extremity
X	Lower Extremity

Multiple, Severe (use only when no single injuries can be selected)		Y
General, Non-wound (burn, drowning, electrocution, etc.)		Z

12 FIRST AID or LIFE SAVING MEASURES that MIGHT have improved the patient's status before arrival at the ER?

1 ☐ None

2 ☐ Restored Respiration

3 ☐ Cardiac Massage

4 ☐ Controlled Hemorrhage

5 ☐ More Careful Movement

6 ☐ Faster Transportation

7 ☐ Other ______

13 ☐ DEAD on Arrival ☐ DIED in ER ______ (Time) AM ☐ PM ☐

Apparent Cause of Death ______

14 **CASE SEVERITY SCALE**

☐ 1 Minor, Trivial

☐ 2 Moderate

☐ 3 Severe

☐ 4 Critical

FIGURE 8A. Emergency room check sheet (front side)

15 PERFORMANCE OF RESCUE PERSONNEL

☐ Satisfactory ☐ Unsatisfactory

16 REMARKS

If performance of rescue personnel was unsatisfactory, or if any steps should have been taken that were not, please describe here. Recommend corrective measures if you deem them necessary.

Signature of Reporting Physician or Nurse

____

This form should be completed on each patient brought to your emergency room by a Rescue Unit. At the end of each week, all accumulated forms should be sent to:

(RESPONSIBLE OFFICER
OF EMERGENCY SQUAD,
AMB. SERVICE, ETC.)

In event of an unsatisfactory performance by a Rescue Crew, the form on that case should be sent in immediately so that corrective action can begin.

FIGURE 8B. Emergency room check sheet (reverse side)

CHAPTER VI

SAFE DRIVING PRACTICES

INTRODUCTION

Most drivers possess a natural inclination to drive at excessive speeds. Sound thinking should tell us it is better to drive slower, and arrive safely at a given destination, than not to arrive there at all.

When dealing with the problem of "safe speeds" vs. "excessive speeds", definite facts must be included, such as: (1) the driver's physical and mental ability; (2) the condition and type of motor vehicle used; (3) the weather; (4) the road condition.

It can be said that a speed considered to be a safe speed for one driver may be an excessive speed for another. Inexperienced and excitable drivers often become overzealous, a characteristic which will cause them to drive at unreasonable and unsafe speeds. The use of warning lights and sirens is to permit the emergency ambulance to travel at a constant speed with the flow of traffic.

RESPONDING TO THE EMERGENCY

DRIVER'S RESPONSIBILITY

The driver of an emergency ambulance vehicle is responsible for the safe operation of that vehicle; therefore, it is necessary for him to understand the limitations involving the use of red warning lights and sirens, mounted on the emergency equipment.

RED LIGHT

The flashing red light is of more value as a warning device to oncoming traffic than it is when used to alert drivers of vehicles being approached from the rear. When no visual obstruction exists, a red flasherlight mounted on the emergency unit is often more effective than a siren as a warning device, because it can attract the attention of oncoming drivers from a greater distance straight ahead. A small red light is ineffective.

SIREN

The siren is an excellent warning device, but it too has limitations caused by high noise levels, closed automobile windows, and the fact that sound waves created by a vehicle-mounted siren are directional. In certain instances, test results proved that the sounds could be heard approximately three times as far to the front as was possible to either side or to the rear. When ideal conditions prevail, a person with normal hearing and seated in an automobile with only the driver's window open, will hear the siren at a position approximately 1,000 feet to the front of the emergency vehicle. This distance, of course, is subject to changes due to the variation of street noises from trucks, buses, and other sound-producing obstacles. However, the approximate distance that the sound waves of a siren may be heard is reduced roughly by two-thirds when the listener's position is at right angles to the path of the emergency vehicle.

There are also some techniques and precautions which, if observed, will result in a more effective use of the siren and reduce the danger of accidents to emergency vehicles.

When the siren is not automatically controlled, it should be turned on and off alternately in such a manner as to utilize the full range of sound from the lower to the highest pitch. The varying sound pitch will attract attention more effectively. Many persons are deaf to high or low pitches but can hear other tones adequately.

In some states totally deaf persons are issued driving licenses. This is true in Ohio.

DRIVING AN EMERGENCY AMBULANCE VEHICLE

The driver of any emergency ambulance vehicle cannot depend on the flashing of the red light or the sound from a siren on the vehicle to guarantee safe passage or "right of way" through any intersecting street or cross roads. There is a greater danger of accidents at intersections where traffic control lights are in operation than at intersections with "Stop" or "Yield Right of Way" signs, or where intersections have no controls at all.

The public has a right to expect the emergency siren to be used only when a genuine emergency exists. The use of the siren for escorts of distinguished persons, caravans, parades, and other non-emergency uses can lead to resentment and eventual disregard. These practices are becoming less prevalent. They should be not only discouraged but prohibited.

To gain the "right of way" over other vehicles traveling in the same direction, a siren should be actuated sufficiently in advance before overtaking the vehicle so that the driver will have had adequate warning of the approach. The sudden use of a siren immediately behind another vehicle may cause an excited motorist to stop suddenly or swerve so abruptly that his car may be struck by the emergency ambulance vehicle, or possibly it may strike other automobiles or pedestrians.

When an emergency ambulance vehicle is preparing to pass another vehicle, it must be done with caution, especially when it is necessary to drive across the center line of the roadway. In such cases, when a motorist is alerted to the situation he should, if possible, drive to the nearest curb or roadway limit and stop. Such results cannot be expected from all motorists in all situations; therefore, the safety of these people rests in the hands of the emergency unit driver.

No emergency ambulance vehicle should pass another such vehicle while responding to an alarm except when an "all clear" signal has been received from the driver or the officer in charge of the first vehicle, and then, only when it is safe to proceed in the judgment of the second vehicle's driver. A safe distance of five hundred feet should be maintained between public safety vehicles when two or more units are responding together to the same emergency.

The careful selection of sound-thinking and intelligent drivers, properly trained, will help solve this problem; however, it is essential that all drivers understand speed in relation to "reaction distance", "braking distance", and "stopping distance", explained herein:

Speed: The miles per hour a vehicle travels.

Reaction Distance: The distance a vehicle will travel while a driver is transferring his foot from the accelerator to the brake pedal after he perceives danger.

Braking Distance: The distance a vehicle will travel from the place where the first application of the brake was made to the place where the vehicle stopped.

Stopping Distance: The sum of the reaction distance plus the braking distance.

These distances will vary with the physical and mental alertness of the driver, the speed, type and condition of the vehicle, the number, type and condition of the brakes, the tire sizes, and the weight of the vehicle when fully equipped, plus the type and condition of the road surface.

For example, at 40 m.p.h. a vehicle is traveling approximately 59 feet per second. This requires a distance of 44 feet (reaction distance) for the average driver to react and apply the brakes. In most cases the vehicle will have traveled an additional 88 feet (braking distance) before it stops. This adds up to a total of 132 feet (stopping distance) which is the approximate total number of feet required to halt the vehicle. At speeds lower than 40 m.p.h., it is possible to control the apparatus with some degree of safety. With higher speeds, such as 60 m.p.h., the stopping distance increases to an approximate 264 feet.

Drivers should remember that they are responsible for the lives of their fellow squadmen, the victims, and others.

TRANSPORTING VICTIM TO THE HOSPITAL

Few, if any, emergencies require the need for excessive road speeds when transporting the victim. Along with this, poor driving practices such as swerving, fast turns, and sudden changes often increase the extent of the injury and create an adverse effect on the victim. This action is improper in all respects.

Another major danger associated with a speeding or carelessly operated squad vehicle is the possibility of being in a traffic accident. Such a situation would cause a delay in assisting those involved in the original emergency, plus the possibility of obtaining more victims and often destroying services for which the squad vehicle was purchased.

The safe speed for any emergency run must be established while the run is being made, and it must be based on the weather, streets, traffic, the driver, and the victim's condition. Because of the seriousness of this situation, there must be adequate planning and wholehearted cooperation of all persons concerned in order to make any emergency squad a successful operating unit.

CHAPTER VII

CONTROLLING THE SITUATION

INTRODUCTION

A squadman's first responsibility in any emergency is to the victim. However, since squadmen are often the first trained personnel to arrive at an emergency, it is sometimes necessary for them to do other things which are not, strictly speaking, victim care, in order to perform their function adequately without endangering their own safety and the safety of others.

HIGHWAY ACCIDENTS

In most situations a victim should receive "on the spot" emergency care before being moved for any purpose. Often immediate assistance to a highway victim is essential before adequate warning signals are set out to alert oncoming traffic. In such instances, the warning lights on the squad vehicles can be used to excellent advantage. They will provide some protection to the victim and the squad personnel against injuries or death. The procedure to follow must be decided for each individual case by the squadman-in-charge at the accident. Squadmen should not deviate from the "victim care" outlined elsewhere in this manual, when considering whether to move the victim to safer area, unless the impending danger creates an additional hazard to the victim or squadmen.

Unless some plan of action is set up, practiced, and understood by squad personnel, there may be confusion at the scene of a highway emergency. Figure 1 shows efficient, pre-planned handling of a highway accident.

FLAGS AND FLARES

Section 4513.28 R. C. of Ohio states that in case of a highway emergency, warning signals shall be placed forty paces or approximately one hundred feet both to the front and to the rear of the vehicle.

If the site of emergency is near a curve, crest of a hill, or place where the vision of oncoming traffic may be obstructed, the warning signals should be placed to give ample warning.

This code directs all emergency squad units to provide for the protection of all persons directly or indirectly concerned with highway emergencies. These warning devices must be used with due regard for the common hazards each may present in a particular situation. For example, open flames, lights, or non-vapor-proof lanterns must not be used in an area filled with gasoline or other flammable vapors.

When the job of caring for the victim demands the squad members' entire personal attention, it is then necessary for the squadman in charge to direct some other person to set out whatever signaling device is suitable for the existing condition.

CLEAN - UP

The Ohio Driver's Manual states, "Any person removing a wrecked or damaged vehicle from a highway shall remove any glass or other injurious substance dropped upon the highway from such vehicle."

The above quotation is not to imply that the emergency squad members are responsible for the removal of such substances dropped upon the highway, but rather to point out with whom this responsibility lies. Some of the most common substances found in a clean-up situation are:

Gasoline: This must be flushed from the highway with large quantities of water. Consideration must be given to where the gasoline and water will run and what additional action, if any, is necessary. For example: Should the gasoline be flushed to a nearby creek, what are the potential dangers and what lies within its path? When the gasoline is flushed into a sewerage system that leads to a sewage disposal plant, the person on duty at the disposal plant should be notified immediately. When it is flushed into a sewerage system in a closely populated area, it is wise to inspect these buildings for gasoline fumes and advise the occupants to discharge water into their floor drains to assure having adequate water in the "trap". This will close off a drain and lock the fumes out of a house.

Both a powder and a liquid are availabe for use on gasoline to reduce the fire danger. The powder is spread on the gasoline and then flushed with water. The liquid is sprayed over the gasoline and then flushed away. Either of these materials will make a nonflammable emulsion that is easily flushed away.

Glass: Broken glass in most cases presents no special hazard in having it removed from the highway but, as in many other highway situations, a constant watch for approaching vehicles must be maintained. A reasonable signal such as those previously mentioned should be given in advance to stop or slow down the traffic, to prevent injury or possible death to members of the clean-up crew.

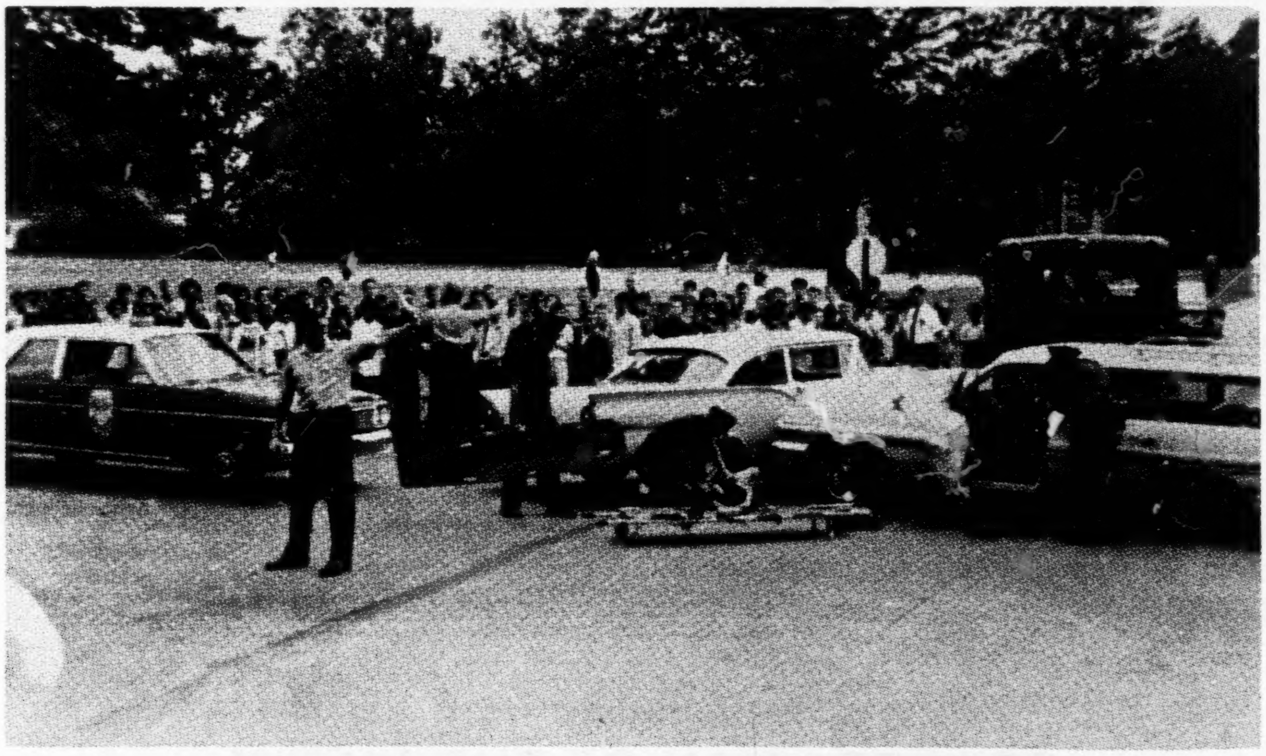
Blood: This provides a somewhat different problem than that encountered in similar situations. Removing the blood from the highway is a simple operation when done by flushing. But the difficulty arises when a "weak-stomached person" is an unwanted spectator who must get all the details first hand. Then just about the time the job is completed, this person "passes out" and a new problem is encountered.

Miscellaneous Situations: There are numerous situations that could be described here, such as one where a large milk supply transport truck overturned and spilled the entire contents over the highway. Another is where a farm produce truck was involved in an accident and most of the contents were distributed across the highway. Regardless of the situation there are many factors to be considered, such as the substance involved, where it occurred, and how it can be corrected. Weather conditions also play an active part in deciding on a course of action. During freezing weather a method not involving water may be necessary. But when water is necessary to do the job, a supply of salt, sand or other like substance may be needed to make the area safe for both motorists and pedestrians. This, as previously stated, is not a direct function of the squad but it is their responsibility to request assistance through certain local authorities by stating the need for additional personnel and supplies.

COOPERATION BY PREPLANNING

An emergency squad will, in many cases, request cooperation from the local police department, county sheriff's office, State Highway Patrol, and the highway department. Squad personnel should attend to the emergency as it concerns emergency care and rescue, and let the law enforcement agency handle the other people and traffic problems.

Emergency squad supervisors should seek cooperation through preplanning with the local police, county sheriff, State Highway Patrol and the highway department. Each has a definite place and each group should cooperate with the other to develop a plan, before the emergency rather than at the scene of the emergency. To best accomplish the desired cooperation, it is suggested planning be done with the top officials of the organizations concerned. At this level, definite agreement can be made which will not be contradicted later. (See Figure 1.)



Courtesy Sharon Twp. F. D. & Worthington, O., P.D.

FIGURE 1. Cooperation at an accident scene. The victims are being cared for by the squadmen while police officers are controlling the bystanders and traffic. Note that one squadman is examining a victim on the road and another is examining a victim in the car. The other squadmen are preparing equipment that probably will be needed. Only by good preplanning between the squad officers and the local police agencies will such effective handling of an accident be possible.

HOME SITUATIONS

Squadmen must have the ability to handle the relatives and friends of the victim, to the end that they will not interfere with the victim's care or the squadmen. This responsibility might be delegated to one member of the squad while the others proceed with the care of the victim. Hysterical mothers, wives, sisters, and grandmothers always create an added problem for the squadmen. This problem is important and in some cases must be eliminated before the squadmen can give attention to the victim. If this problem is not eliminated, it is very possible to have two victims in place of one. There is no set rule for the squadmen to use to cope with this problem; however, the following situation will present an example which may be helpful.

EXAMPLE

Husband has heart attack. His wife is hysterical.

PROCEDURE

1. Take wife to another room.

2. Ask her questions, to keep her mind occupied.

a. Has your husband had these attacks before?

b. Is he taking medicine? (If so, ask to see it.)

c. What is his medical background?

d. Who is his doctor?

e. What is his parents' medical background?

f. How many children do you have?

g. How old are they and are they away? (Army, college, etc.)

h. What is your husband's age?

Little help will be required by the relative who remains calm in the face of an emergency; however, a word of sympathy and encouragement is well worthwhile.

Do not blame or ridicule a person for feeling as he does. Your job is to help him cope with his feelings.

COOPERATION OF THE VICTIM

Every effort must be made to secure the cooperation of the victim. Often a problem is the additional embarrassment to the victim caused by curious bystanders. It is to the best interest of the squad and the victim to protect the victim from these prying eyes.

For example, if a women should break her leg in a crowded area, she should be covered with a blanket. The examination should be made and the splint put in place by feeling under the blanket. With practice, this can be readily accomplished.

If possible , the area in which the victim or victims are located should be blocked off and shielded from the sight of onlookers.

COOPERATION WITH HOSPITAL PERSONNEL

Giving the best possible care to victims is of primary importance in emergency squad work. One means of doing this is to establish good relationships with the hospital personnel with which the squadmen come in contact, and most especially the emergency-room personnel.

If there is a working agreement between the emergency squad and the regular personnel in the emergency room, the care of the patient from the time he is seen by the squadmen until the time he is admitted to the hospital will not be disrupted. This can only be accomplished if all people who come in contact with the victim work as a team.

The officer in charge of the emergency squad or the chief of the department should meet periodically with the supervisors of the emergency rooms with which his squad comes in contact. This will lead to a better understanding of the objectives of both groups. The emergency-room supervisors are most willing to cooperate with those who transport victims to the hospital.

Upon arrival at the hospital emergency room, tell the nurse just what type of emergency you have and the suspected injuries. Good rapport with the "entire team" means working well with all who come in contact with the victim, especially the emergency room personnel.

After the victim is made as comfortable as possible and lifesaving procedures are carried out, squadmen should give the emergency room nurses all possible information:

1. The exact location from which victim was taken.

2. The type of accident.

3. The victim's condition from the time squadmen arrived until the victim arrived at the hospital.

4. The care given by the squad.

5. Whether the proper law enforcement agencies were notified.

OPERATIONS AT A CRIME SCENE

The following information should be of help to all squads. The outlined procedure should be followed at all suspected crime scenes.

Emergency care should not be jeopardized or sacrificed at any time. If there is any thought whatsoever that life may still be present, the care of the patient must take precedence over all other things.

Protecting The Scene

The scene of any unusual death such as at a fire, accident, explosion, unnatural death, etc., should be treated as a crime scene until proven otherwise. If squadmen arrive ahead of any law officers, they should assume the responsibility of protecting the scene.

1. The primary object to be guarded may be a body, an automobile, a room, or an entire building.

2. An area around the primary object may also require protection, depending on the type of crime.

Authority should be turned over to the police agency as soon as a representative arrives. If a patient must be transported to a hospital, one squadman could be left at the scene to await the arrival of the police agency.

Typical Procedure

All crime scene investigations more or less follow the same general pattern. The example treated here is a possible homicide. Parts of this procedure, of course, are not applicable in other types of crime.

The following information should be obtained promptly and transmitted to a police agency.

1. Name of deceased, if possible.
2. Exact address and location of the body.
3. Telephone number where squadman can be reached or is calling from.
4. Apparent cause and time of death, if known.
5. What assistance, if any, is needed.

Duties of the first squadmen at the scene are as follows:

1. If the victim must be moved for emergency care, mark in some manner an outline of the body.

2. KEEP THE SCENE INTACT -- AS IS. Never touch, change, or alter anything until investigators arrive.

3. Get the names and addresses of witnesses and persons at the scene.

4. Get the name and address of the person who summoned the squad.

5. Note the weather condition at the time of your arrival.

6. Note the exact position of the body and the condition of the victim's clothing.

7. Note the condition of the victim's hands and any objects in his hands.

8. Note the size and condition of blood stains, if any.

9. If a weapon is found, do not touch it, push it aside or pick it up with a cloth. The weapon should be touched only in the most extreme emergency.

10. All persons found on the scene should be detained for examination, and no unauthorized persons should be admitted to the scene.

11. Do not remove a dead body unless so authorized by the coroner or officer in charge of squad.

12. At least one squadman should remain with the body at all times, until he is relieved by a police agency.

13. Squadmen should not therorize or gossip with citizens about facts of the case. All such information should be given to investigating officers.

14. Note the time of arrival at scene and the names of squad officers present.

Records

All pertinent information should be kept on the squad report at squad headquarters. It may be subpoenaed later, as evidence.

CHAPTER VIII

ANATOMY AND PHYSIOLOGY

INTRODUCTION

To prepare the squadman to render emergency care efficiently and intelligently, it is necessary that he has an understanding of the structure (anatomy) and the workings (physiology) of the human body and its important organs and systems.

THE BODY CAVITIES AND CONTENTS

The human body contains five cavities: (1) the cranial cavity is the space inside the skull that contains the brain; (2) the spinal cavity is the long cylinder-like space inside the spinal column that contains the spinal cord; (3) the thoracic (chest) cavity contains the lungs, heart, aorta, and other blood vessels and nerves; (4) the abdominal cavity, which is separated from the thoracic cavity by the diaphragm, contains the stomach, liver, gall bladder, small intestine, most of the large intestines (colon and secum), pancreas, appendix and spleen. The two kidneys lie behind the abdominal cavity, right underneath its lining; (5) the pelvic cavity contains the reproductive organs, urinary bladder, and the lower part of the intestines. See Figures 1, & 2.

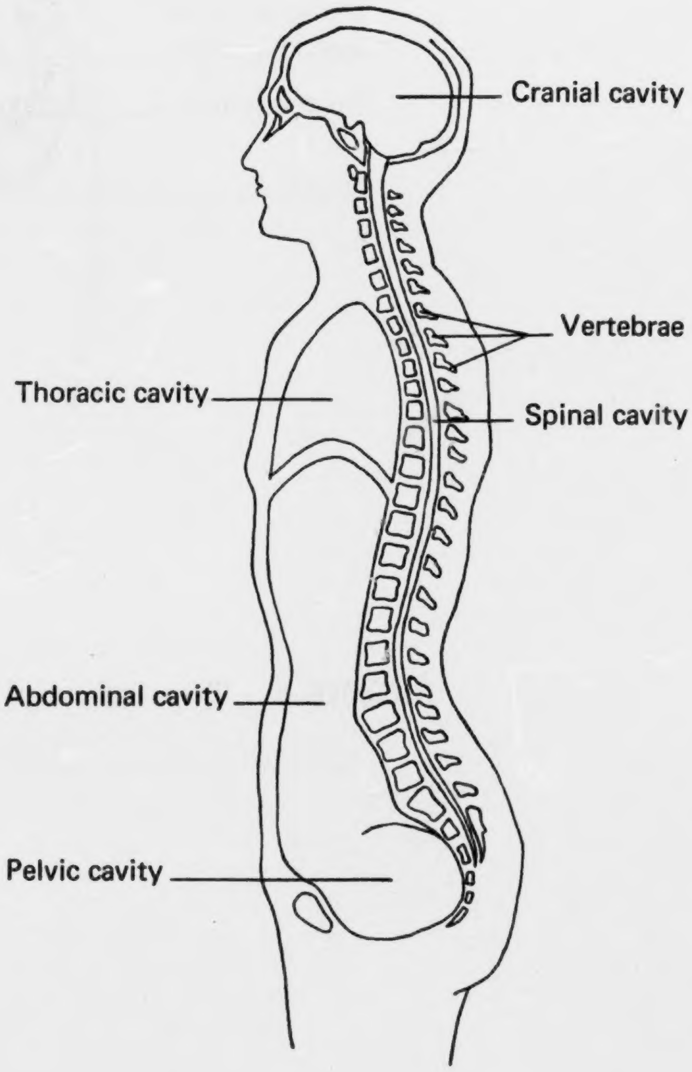


FIGURE 1. Location of the body cavities

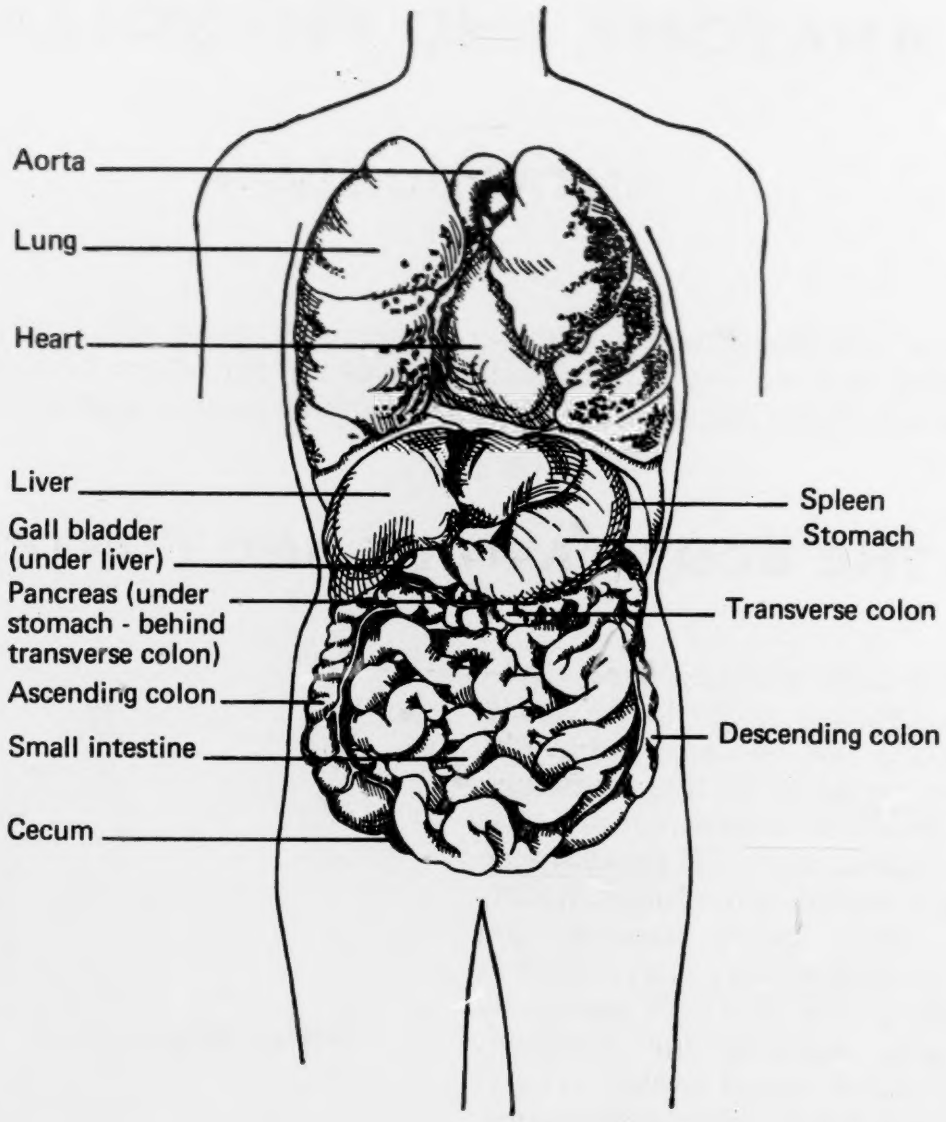

Aorta
Lung
Heart
Liver
Gall bladder (under liver)
Pancreas (under stomach - behind transverse colon)
Ascending colon
Small intestine
Cecum
Spleen
Stomach
Transverse colon
Descending colon

FIGURE 2. The organs of the chest and abdominal cavities

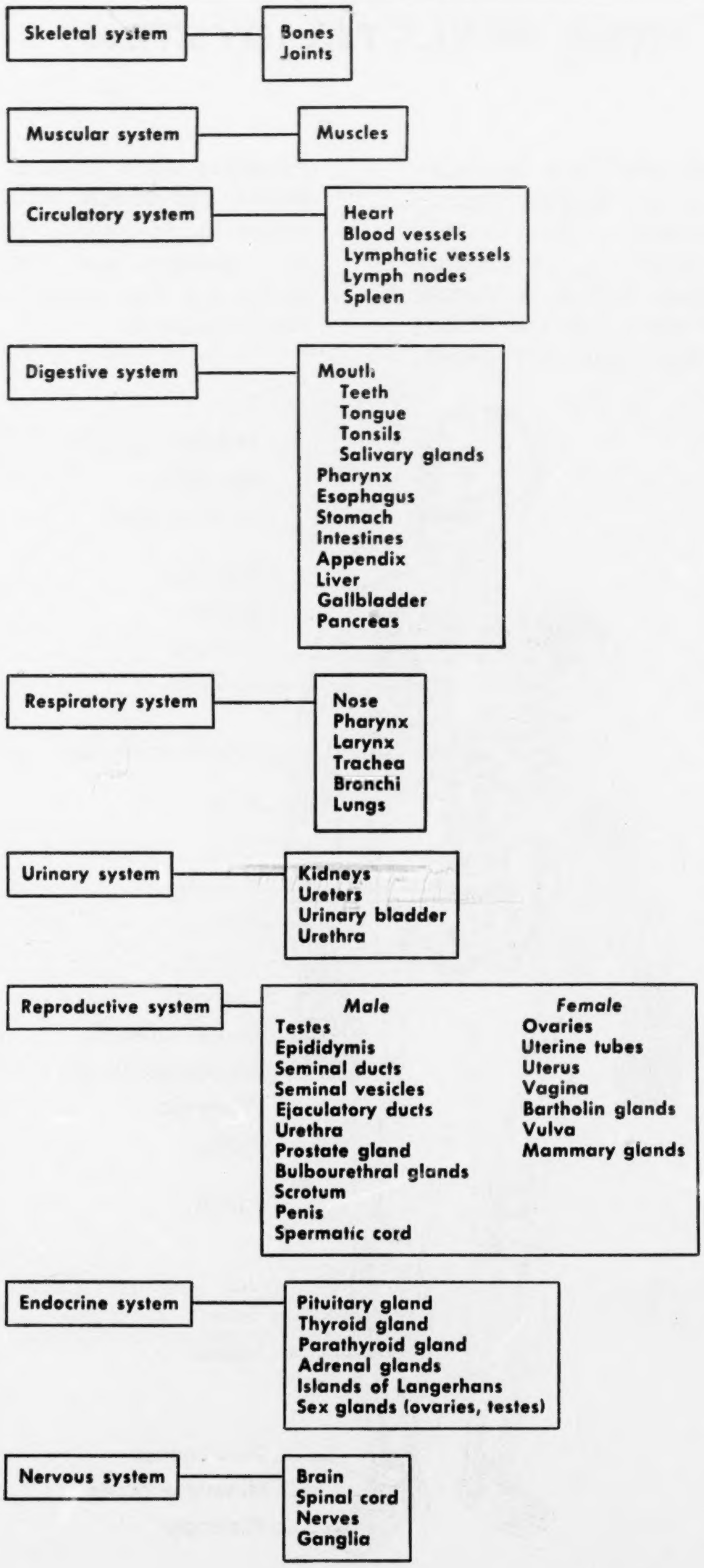

Skeletal system
Bones
Joints
Muscular system
Muscles
Circulatory system
Heart
Blood vessels
Lymphatic vessels
Lymph nodes
Spleen
Digestive system
Mouth
Teeth
Tongue
Tonsils
Salivary glands
Pharynx
Esophagus
Stomach
Intestines
Appendix
Liver
Gallbladder
Pancreas
Respiratory system
Nose
Pharynx
Larynx
Trachea
Bronchi
Lungs
Urinary system
Kidneys
Ureters
Urinary bladder
Urethra
Reproductive system
Male
Testes
Epididymis
Seminal ducts
Seminal vesicles
Ejaculatory ducts
Urethra
Prostate gland
Bulbourethral glands
Scrotum
Penis
Spermatic cord
Female
Ovaries
Uterine tubes
Uterus
Vagina
Bartholin glands
Vulva
Mammary glands
Endocrine system
Pituitary gland
Thyroid gland
Parathyroid gland
Adrenal glands
Islands of Langerhans
Sex glands (ovaries, testes)
Nervous system
Brain
Spinal cord
Nerves
Ganglia

FIGURE 3. The nine body systems and the organs that make up each system

"THE SKELETAL SYSTEM"

The adult human skeleton is composed of 206 bones which can be classified according to shape as long bones, short bones, flat bones and irregular bones. The skeleton forms a strong but flexible framework for the body. It supports and carries the soft parts, protects vital organs from injury, produces red blood cells, and most of the white blood cells. It gives attachment to muscles and tendons, and forms joints so that movements are possible. See Figure 4.

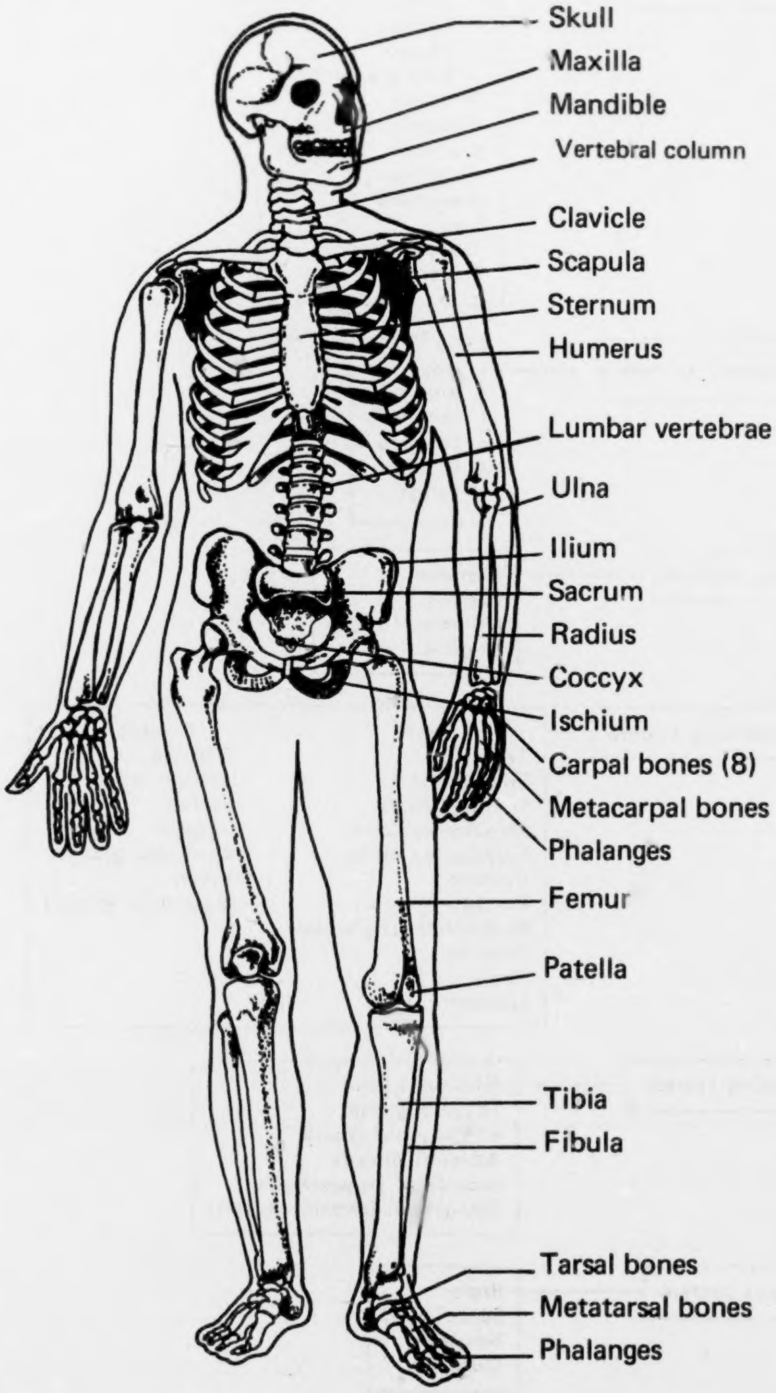

Skull
Maxilla
Mandible
Vertebral column
Clavicle
Scapula
Sternum
Humerus
Lumbar vertebrae
Ulna
Ilium
Sacrum
Radius
Coccyx
Ischium
Carpal bones (8)
Metacarpal bones
Phalanges
Femur
Patella
Tibia
Fibula
Tarsal bones
Metatarsal bones
Phalanges

FIGURE 4. **The human skeleton showing the major bones of the body**

DIVISIONS OF THE SKELETON

The skeletal system consists of two major divisions. These major divisions are in turn broken down into several subdivisions.

The first division is referred to as the "axial skeleton" and it is subdivided into the bones that make up the skull, spine and the thorax. The second division is called the "appendicular skeleton" and consists of the upper extremities including the shoulder girdle, and the lower extremities including the hip girdle. See Figure 5.

Axial skeleton	*Appendicular skeleton*
Skull	Upper extremities
Cranium	Shoulder girdle
Face	Arms
Spine	Hands
Vertebrae	Lower extremities
Thorax	Hip girdle
Ribs	Legs
Sternum	Feet
Ear bones	
Hyoid bone	

FIGURE 5. Main parts of the skeleton

THE SKULL

The skull is composed of 22 bones, 8 of which are closely united to form a bony case which encloses the brain; 14 other bones enter into the formation of the face. The only movable bone in the head is the mandible or lower jaw. See Figure 6.

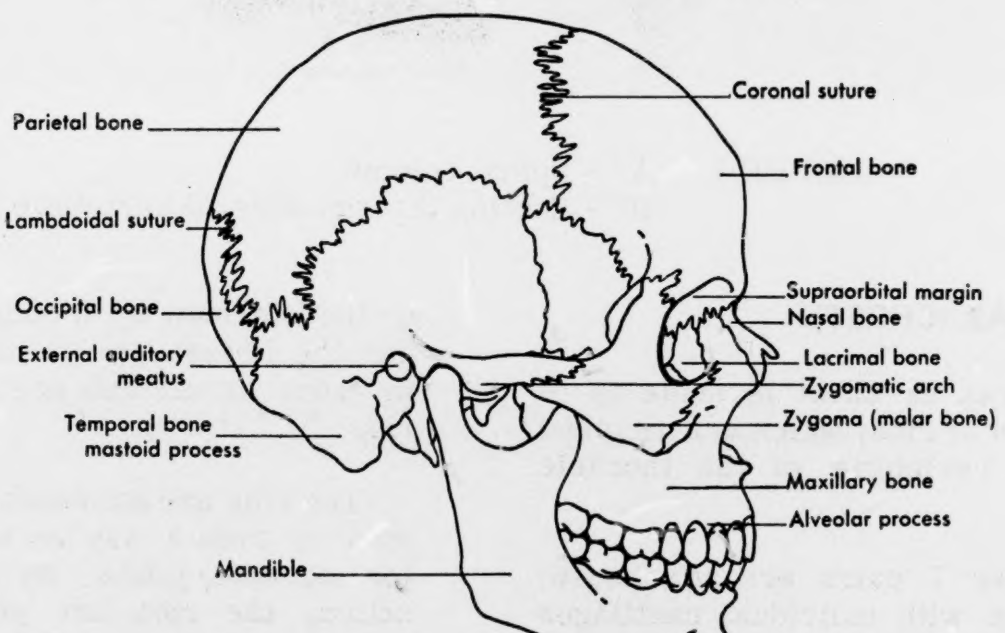

Parietal bone
Lambdoidal suture
Occipital bone
External auditory meatus
Temporal bone mastoid process
Mandible
Coronal suture
Frontal bone
Supraorbital margin
Nasal bone
Lacrimal bone
Zygomatic arch
Zygoma (malar bone)
Maxillary bone
Alveolar process

FIGURE 6. Side view of the skull

THE SPINE (VERTEBRAL COLUMN)

The spine consists of a series of separate bones called vertebrae, which are connected in such a way that they form a flexible, curved rod. The curved shape of the spine makes it exceptionally strong.

The sections of the spine are referred to as regions, such as the top 7 vertebrae which is called the cervical region; the next 12 vertebrae, the thoracic region; and below that, the 5 vertebrae of the lumbar region. The 5 bones of the pelvic region are fused into one bone called the sacrum, and finally, the 4 bones forming the coccyx or tail bone. See Figure 7.

The spine, by necessity, needs to be very strong for it supports the head at the top, the ribs and internal organs are suspended in front, and the hips and legs are attached to its lower section.

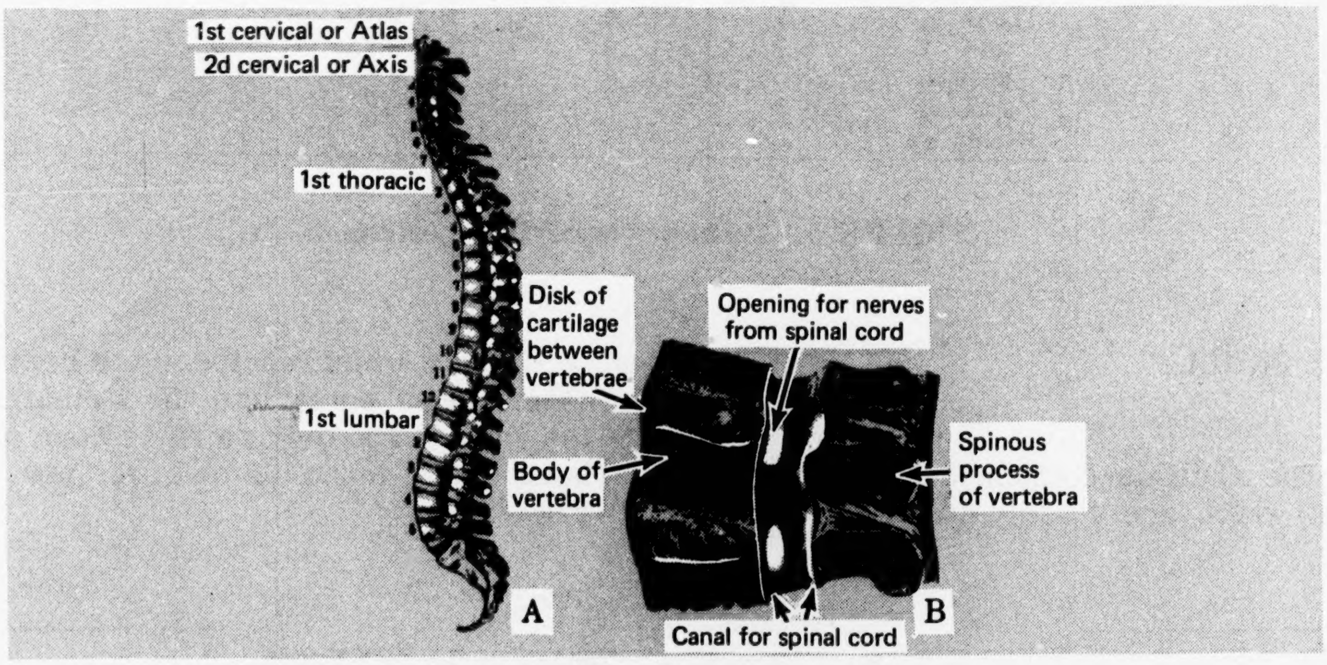

1st cervical or Atlas
2d cervical or Axis
1st thoracic
1st lumbar
Disk of cartilage between vertebrae
Body of vertebra
A
Opening for nerves from spinal cord
Spinous process of vertebra
Canal for spinal cord
B

FIGURE 7. "A" - Spinal column;
"B" - Section through several vertebrae

THE THORAX (CHEST)

The thorax or chest is made up of twelve pairs of ribs, which are attached to the 12 vertebrae of the thoracic spine.

The upper 7 pairs are attached to the sternum with individual cartilages and are often called true ribs. The next three pairs of ribs are attached to the sternum by a common cartilage; and the lowest two pairs do not attach in front at all and are called floating ribs.

The ribs are attached to the spinal column in such a way as to provide true (or movable) joints. By various muscle action, the ribs are permitted to be drawn in or out. This action makes possible the mechanism of breathing.

THE PELVIS

The pelvis is a basin-shaped bony structure that is attached to the two lower sections of the spinal column (sacrum and coccyx). The 2 largest bones of the pelvis are the broad wing-shaped bones (ilium) usually referred to as the hipbones. The pelvis contains the sockets into which the thigh bones (femur) fit to form the ball-and-socket joint of the hip.

THE UPPER EXTREMITIES

Each upper extremity consists of 32 bones -- the collarbone (clavicle), the shoulder blade (scapula), the arm bone (humerus), the 2 bones of the forearm (radius, thumb side and the ulna, little finger side), the 8 bones of the wrist (carpals), the 5 bones of the hand (metacarpals), and the 14 bones of the fingers (phalanges).

THE LOWER EXTREMITIES

Each lower extremity consists of 30 bones--the thigh bone (femur), the kneecap (patella), the 2 bones of the leg (tibia or shin bone, and the fibula), the 7 bones of the ankle (tarsal bones), 5 bones of the foot (metatarsals), and the 14 bones of the toes (phalanges).

Both the upper and lower extremities can perform many movements. This many-boned framework is connected by movable joints.

JOINTS

Where two or more bones come together, they form a joint. The ends of bones forming joints are covered by cartilage; in a free-moving joint there is a membrane between the cartilage covering the ends of the bones that secretes a fluid to keep the joint lubricated. See Figure 8. The bones forming a joint are held in place by strong ligaments and bands of fibrous tissue. A sac or capsule encloses a free-moving joint. Some joints, such as those in the skull, are immovable. A few joints allow only slight movement, but by far the majority of joints allow movement in many directions.

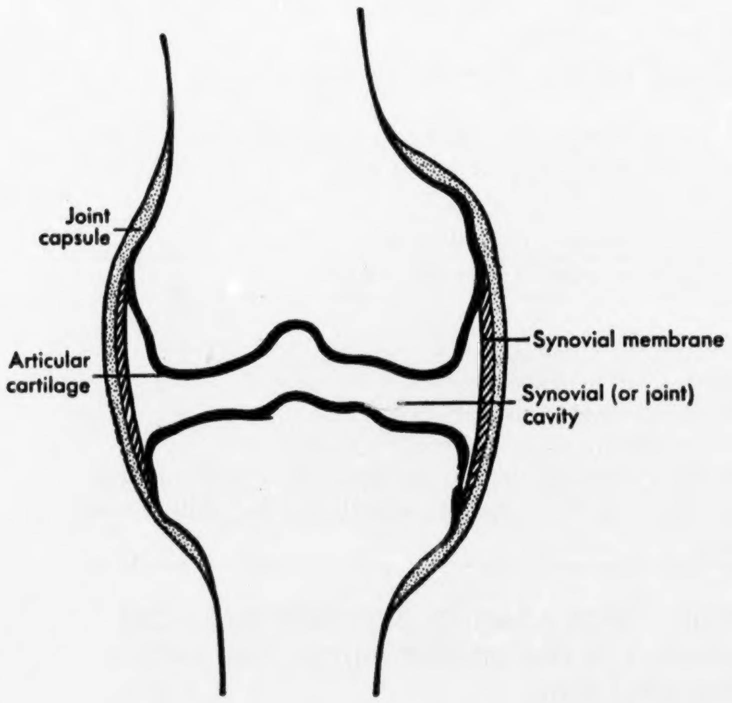


FIGURE 8. Structure of a freely movable joint

Name	*Number*	*Description*
Cranial bones		
Frontal	1	Forehead bone; also forms front part of floor of cranium and most of upper part of eye sockets; cavity inside bone above upper margins of eye sockets (orbits) called *frontal sinus;* lined with mucous membrane
Parietal	2	Form bulging topsides of cranium
Temporal	2	Form lower sides of cranium; contain *middle and inner ear structures; mastoid sinuses* are mucous-lined spaces in *mastoid process,* the protuberance behind ear; *external auditory canal* is tube into temporal bone
Occipital	1	Forms back of skull; spinal cord enters cranium through large hole *(foramen magnum)* in occipital bone
Sphenoid	1	Forms central part of floor of cranium; pituitary gland located in small depression in sphenoid called *Turk's saddle* or sella turcica
Ethmoid	1	Complicated bone that helps form floor of cranium, side walls and roof of nose and part of its middle partition (nasal septum), and part of orbit; contains honeycomb-like spaces, the *ethmoid sinuses; superior and middle turbinate bones* (conchae) are projections of ethmoid bone; they form "ledges" along side wall of each nasal cavity
Face bones		
Nasal	2	Small bones that form upper part of bridge of nose
Maxillary	2	Upper jawbones; also help form roof of mouth, floor, and side walls of nose and floor of orbit; large cavity in maxillary bone is *maxillary sinus*
Zygoma (malar)	2	Cheek bones; also help form orbit
Mandible	1	Lower jawbone
Lacrimal	2	Small bone; helps form medial wall of eye socket and side wall of nasal cavity
Palatine	2	Form back part of roof of mouth and floor and side walls of nose and part of floor of orbit
Inferior turbinate	2	Form curved "ledge" along inside of side wall of nose, below middle turbinate
Vomer	1	Forms lower, back part of nasal septum
Ear bones		
Malleus	2	Tiny bones in middle ear cavity in temporal bone; name, malleus, means hammer, shape of bone
Incus	2	Incus means anvil, shape of bone
Stapes	2	Stapes means stirrups, shape of bone
Hyoid bone	1	U-shaped bone in neck at base of tongue
Vertebral column		
Cervical vertebrae	7	Upper seven vertebrae, in neck region; first cervical vertebra called *atlas;* second called *axis*
Thoracic vertebrae	12	Next twelve vertebrae; ribs attach to these
Lumbar vertebrae	5	Next five vertebrae; those in "small" of back
Sacrum	1	In child, five separate vertebrae; in adult, fused into one
Coccyx	1	In child, three to five separate vertebrae; in adult, fused into one

FIGURE 9. Bones of the skeleton - This chart is provided to assist those who are interested in the proper names and locations of the complete skeleton.

Name	*Number*	*Description*
Thorax		
True ribs	14	Upper seven pairs; attached to sternum by way of *costal cartilages*
False ribs	10	Lower five pairs; lowest two pairs do not attach to sternum, therefore, called *floating ribs;* next three pairs attach to sternum by way of costal cartilage of seventh ribs
Sternum	1	Breast bone; shaped like a dagger; piece of cartilage at lower end of bone called *xiphoid process*
Upper extremities		
Clavicle	2	Collar bones; only joints between shoulder girdle and axial skeleton are those between each clavicle and sternum
Scapula	2	Shoulder bones; scapula plus clavicle forms shoulder girdle; *acromion process*—tip of shoulder that forms joint with clavicle; *glenoid cavity*—arm socket
Humerus	2	Upper arm bone
Radius	2	Bone on thumb side of lower arm
Ulna	2	Bone on little finger side of lower arm; *olecranon process*—projection of ulna known as the elbow or "funny bone"
Carpal bones	16	Irregular bones at upper end of hand; anatomical wrist
Metacarpals	10	Form framework of palm of hand
Phalanges	28	Finger bones; three in each finger, two in each thumb
Lower extremities		
Pelvic bones	2	Hip bones; *ilium*—upper, flaring part of pelvic bone; *ischium*—lower, back part; *pubic bone*—lower, front part; acetabulum—hip socket; *symphysis pubis*—joint in midline between two pubic bones; pelvic inlet—opening into *true pelvis,* or pelvic cavity; if pelvic inlet is misshapen or too small, infant skull cannot enter true pelvis for natural birth
Femur	2	Thigh or upper leg bones; *head of femur*—ball-shaped upper end of bone; fits into acetabulum
Patella	2	Kneecap
Tibia	2	Shin bone; *medial malleolus*—rounded projection at lower end of tibia commonly called inner ankle bone
Fibula	2	Long slender bone of lateral side of lower leg; *lateral malleolus*—rounded projection at lower end of fibula commonly called outer ankle bone
Tarsal bones	14	Form heel and back part of foot; anatomical ankle
Metatarsals	10	Form part of foot to which toes attach; tarsal and metatarsal bones so arranged that they form three arches in foot: *the inner longitudinal arch* and the *outer longitudinal arch,* both of which extend from front to back of foot, and transverse or *metatarsal arch* that extends across foot
Phalanges	28	Toe bones; three in each toe, except great toes, where there are two
Total	206	

FIGURE 9. Bones of the skeleton. (Continued)

THE MUSCULAR SYSTEM

Muscles are made up of a specialized kind of tissue, that respond to nerve impulses that make it possible to move the different parts of the body.

There are three major types of muscles:

1. Skeletal Muscles - that attach to bones and permit voluntary movement - longest of all muscle fibers. See Figure 10.

2. Smooth Muscles - the smooth muscle that makes up the intestines. These are shorter than skeletal muscles and their action is involuntary. See Figure 11.

3. Cardiac Muscle - The muscle fibers seem to branch into each other and are involuntary in action. The heart is the only organ that has the branching type muscle. See Figure 12.

Muscles permit movement, maintain posture, and produce heat. To produce movement the muscles are attached, usually to two bones, as the muscle shortens or contracts, it pulls the bones closer together. The muscles are attached to the bones either directly or by strong bands of fibrous tissue called tendons. All movements are controlled by the brain through impulses to the nerves on to any muscle or group of muscles which it wishes to call into action.

The contraction and expansion of skeletal muscles produces heat that maintains normal body temperature. This can be quite evident when we are performing strenuous excercise or when very cold we start to shiver.

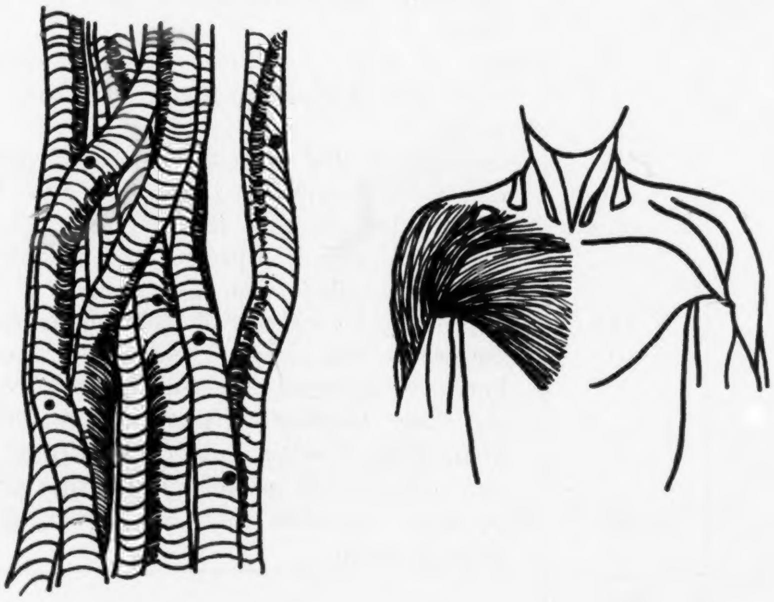


FIGURE 10. Skeletal muscle - The left diagram shows the long appearance of the muscle tissue, and at the right their attachment to a part of the body.

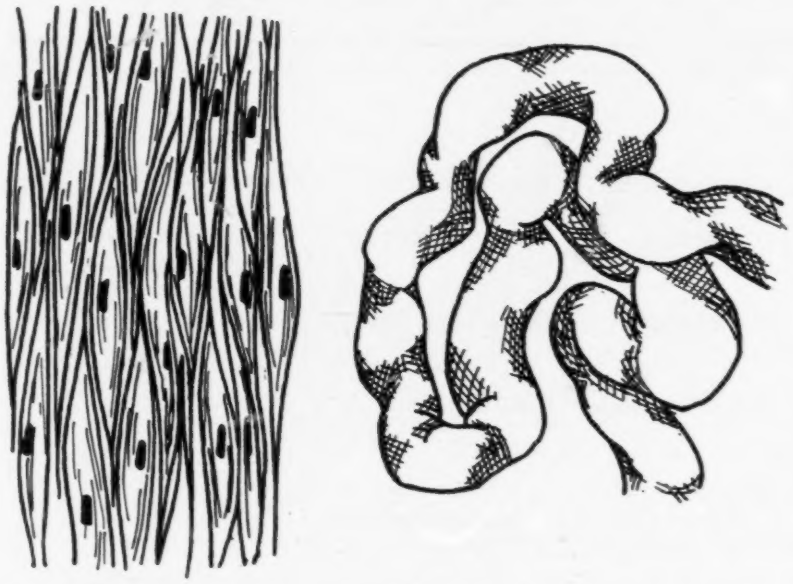


FIGURE 11. Smooth muscle - The left diagram shows the muscle tissue magnified. They are shorter than skeletal muscles. At right a section of the intestines that contain smooth muscle.

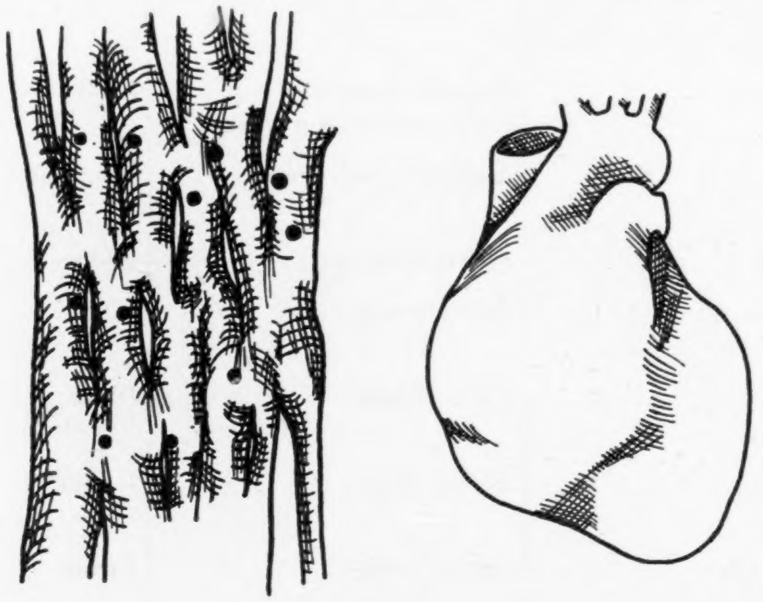


FIGURE 12. Cardiac muscle - The left diagram shows the cardiac muscle tissue magnified. Note how the fibers branch into each other. At the right is the heart, the only organ that has this type of "branching" muscle.

Muscle tone and strength maintains posture. If back muscles are weakened, the individual may have a slumped appearance. If neck muscles become unable to function, the head would droop forward.

Muscles depend on the work of many other systems in order to do their work. They depend upon the respiratory, circulatory and digestive systems, as well as the nervous and skeletal systems.

Part moved	*Flexors*	*Extensors*	*Abductors*	*Adductors*
Upper arm	Pectoralis major	Latissimus dorsi	Deltoid	Pectoralis major and latissimus dorsi contracting together
Lower arm	Biceps brachii	Triceps brachii	None	None
Thigh	Iliopsoas	Gluteus maximus	Gluteus medius and minimus	Adductor group
Lower leg	Hamstrings	Quadriceps femoris group	None	None
Foot	Tibialis anterior	Gastrocnemius soleus		
Trunk	Iliopsoas and rectus femoris	Erector spinae (sacrospinalis)		

FIGURE 13. Muscles grouped according to their function

Muscle	*Function*	*Insertion*	*Origin*
Pectoralis major	Flexes *upper arm* Helps adduct *upper arm*	Humerus	Sternum Clavicle Upper rib cartilages
Latissimus dorsi	Extends *upper arm* Helps adduct *upper arm*	Humerus	Vertebrae Ilium
Deltoid	Abducts *upper arm*	Humerus	Clavicle Scapula
Biceps brachii	Flexes *lower arm*	Radius	Scapula
Triceps brachii	Extends *lower arm*	Ulna	Scapula Humerus
Iliopsoas	Flexes *trunk*	Ilium Vertebrae	Femur
Iliopsoas	Flexes *thigh*	Femur	Ilium Vertebrae
Gluteus maximus	Extends *thigh*	Femur	Ilium Sacrum Coccyx
Gluteus medius	Abducts *thigh*	Femur	Ilium
Gluteus minimus	Abducts *thigh*	Femur	Ilium
Adductors	Adduct *thigh*	Femur	Pubic bone
Hamstring group	Flexes *lower leg* Helps extend *thigh*	Tibia Fibula	Ischium Femur
Quadriceps femoris group, including rectus femoris	Extends *lower leg* Helps *flex thigh*	Tibia	Ilium Femur

FIGURE 14. The functions, origins, and insertions of muscle

THE NERVOUS SYSTEM

The various parts of the body and the organs controlling the body functions are kept in touch with each other by the nervous system. The nervous system really consists of two separate but interconnected and coordinated systems, (1) the central nervous system, sometimes called the cerebrospinal system, and (2) the autonomic nervous system which consists of the parasympathetic and the sympathetic nervous system.

The central nervous (cerebrospinal) system is composed of the brain and spinal cord. The brain is a collection of nerve centers, each center being a central station for some part of the body, much like a central telephone station, with trunk lines or nerves connecting the parts of the body with their particular centers. Leaving the brain, these trunk nerves are bundled together into the spinal cord. As the spinal cord passes down through the spinal cavity, branches are given off to all parts and organs of the body.

Nature has provided protection for the delicate nervous system by enclosing the brain in a bony case (the skull) and the spinal cord by enclosing it in the center of the body vertebrae. Injuries to the head, especially when the skull is fractured, may cause serious damage to the delicate nerve tissue of the brain. Likewise, fractures of the backbone or spine may cause the spinal cord to be cut or pinched so severely as to result in paralysis below the point of injury. Cutting or severe pinching of a trunk nerve after it has left the spinal cord, as in the arm or leg, will cause paralysis below the point of injury. The nerves entering and leaving the spinal cord are mainly of two types--sensory nerves entering the cord, which convey impressions of sensations, such as heat, cold, touch, and pain from different parts of the body to the brain; and motor nerves, leaving the spinal cord, conveying impulses from the brain to the muscles causing movement.

The autonomic nervous system consists of a series of nerve centers called ganglions in the chest and abdominal cavity along the spinal column. Each of these ganglions or nerve centers, although interconnected to the central nervous system, presides over and controls vital organs and vital functions. This system is not under control of the will, but through it involuntary muscles are stimulated to act alike during periods when we are awake and when we are asleep. Thus, the heart beats, we breathe, blood pressure is maintained, we digest our food, and excretory organs function independently of any effort on our part.

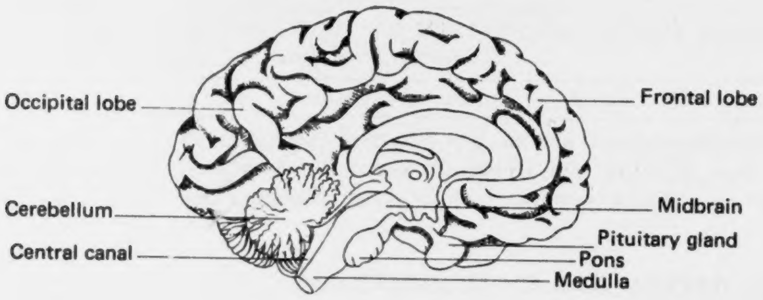


FIGURE 15. Cross section of the human brain

The nervous system plays a very important part in conditions of shock that result from injuries or exposure to the exciting causes of shock.

THE BRAIN

The three most prominent parts of the brain are the cerebrum, the cerebellum, and medulla. The cerebrum is the largest part of the human brain. Its interior is composed mostly of nerve fibers arranged in bundles called tracts. The function of the cerebrum is to develop mental processes of all types, including voluntary control of movements and consciousness.

The cerebellum is the second largest part of the human brain. It helps to control muscle contractions so they produce coordinated movements to maintain our balance and move smoothly.

The medulla is the lowest part of the brain. Actually, it is an enlarged extension of the spinal cord in the cranial cavity. The medulla must be considered a most vital part of the brain for it controls the heartbeat, blood pressure, and respiration. See Figures 15, 16 & 17.

*Cranial nerve**	*Conducts impulses*	*Functions*
I. Olfactory	From nose to brain	Sense of smell
II. Optic	From eye to brain	Vision
III. Oculomotor	From brain to eye muscles	Eye movements
IV. Trochlear	From brain to external eye muscles	Eye movements
V. Trigeminal (or trifacial)	From skin and mucous membrane of head and from teeth to brain; also from brain to chewing muscles	Sensations of face, scalp, and teeth; chewing movements
VI. Abducens	From brain to external eye muscles	Turning eyes outward
VII. Facial	From taste buds of tongue to brain From brain to face muscles	Sense of taste; contraction of muscles of facial expression
VIII. Auditory (or acoustic)	From ear to brain	Hearing Sense of balance
IX. Glossopharyngeal	From throat and taste buds of tongue to brain; also from brain to throat muscles and salivary glands	Sensations of throat; taste; swallowing movements; secretion of saliva
X. Vagus	From throat, larynx, and organs in thoracic and abdominal cavities to brain; also from brain to muscles of throat and to organs in thoracic and abdominal cavities	Sensations of throat, larynx, etc.; swallowing, peristalsis, heart contractions, etc.
XI. Spinal accessory	From brain to certain shoulder and neck muscles	Shoulder movements; turning movements of head
XII. Hypoglossal	From brain to muscles of tongue	Tongue movements

*The first letters of the words of the following sentence are the first letters of the names of cranial nerves: "On Old Olympus' Tiny Tops A Finn and German Viewed Some Hops." Many generations of students have used this or a similar sentence to help them remember the names of cranial nerves.

FIGURE 16. The cranial nerves and their functions

Structure	*Parasympathetic control*	*Sympathetic control*
Heart muscle	Slower heartbeat	Faster heartbeat
Most blood vessels	None	Constricted
Blood vessels in skeletal muscles	None	Dilated
Digestive tract	Increased peristalsis and increased secretion	Decreased peristalsis; decreased secretion
Adrenal glands	Decreased epinephrine secretion	Increased epinephrine secretion
Sweat glands	None	Increased sweat secretion

FIGURE 17. The functions of the autonomic nervous system

THE RESPIRATORY SYSTEM

The human body can be deprived of food and water for extended periods, but it must have a continuous supply of oxygen if it is expected to survive. Every body cell requires oxygen to live and to function properly. During the act of respiration, air is taken into the lungs during inspiration and forced out of the lungs during expiration.

The respiratory system consists of the nose and mouth, pharynx, larynx, trachea, bronchi, and lungs. In addition, there are the respiratory muscles (the diaphragm) and the breathing control center in the brain.

As the inhaled air passes through the nose and mouth, it is warmed and, by means of the hairs in the nose and the moist mucous membranes, much of the dust in the air is filtered out.

The pharynx (throat) is a continuation of the nose and mouth; at its lower end are two openings, one in front of the other. The one in front is called the trachea (wind pipe) and leads to the lungs. The one behind is called the esophagus (food pipe) and leads to the stomach.

At the top of the trachea is a flap called the epiglottis which closes over the trachea during the act of swallowing to prevent food or liquid from entering it.

The larynx or voice box is located just below the pharynx. This area is commonly known as the "Adams Apple." The voice box contains two short fibrous bands called vocal cords. Muscles attached to these cords can cause them to be short and tight or long and relaxed which affects the tonal changes in your voice.

The trachea extends into the chest cavity and divides into the right and left bronchi, one passing to the right lung and the other to the left lung. Each bronchus enters the lung and divides and subdivides into many branches known as bronchial tubes. The bronchial tubes continue to subdivide and branch off into the smallest branches or air sacs called the alveoli. The alveoli are shaped like miniature clusters of grapes. It is here that the air is brought into contact with the minute capillaries of the lungs and the exchange of carbon dioxide and oxygen takes place. See Figure 18.

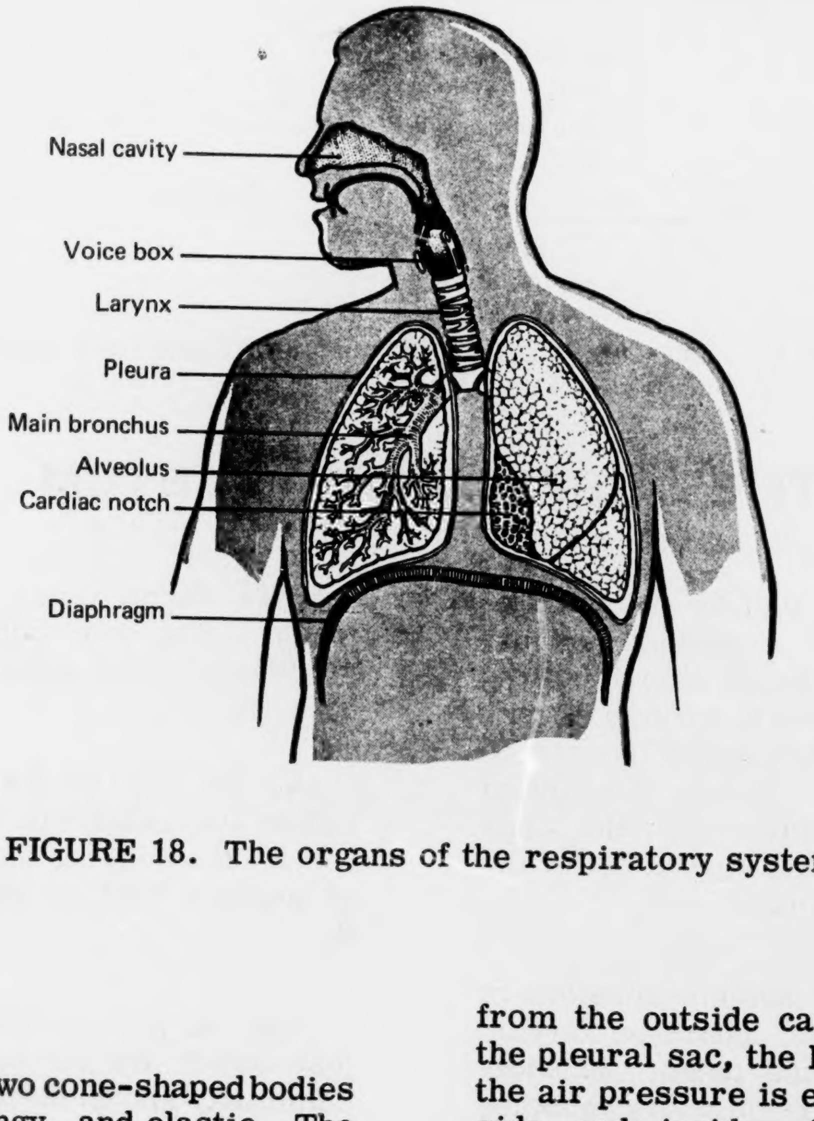


FIGURE 18. The organs of the respiratory system

THE LUNGS

The lungs are two cone-shaped bodies that are soft, spongy, and elastic. The outside of each lung is covered by a closed sac called the pleura. The inner part of the lungs communicates freely with the outside air through the windpipe. The outside of the lungs is protected from air pressure by the walls of the chest cavity, creating a lessened pressure within the enveloping lung sac. The air pressure within the lungs expands them until they fill almost the entire chest cavity.

If any air gets through the chest wall, or if the lung is punctured so that air from the outside can communicate with the pleural sac, the lungs shrink because the air pressure is equalized on the outside and inside of the chest cavity.

After subdividing into very small branches the bronchial tubes end in a group of air cells resembling a bunch of grapes, except that they are many times smaller. Around each air cell, which has very thin walls, is a fine network of small blood vessels or capillaries. The blood in these capillaries gives up the carbon dioxide and other waste matter brought from tissue activity all over the body, through the thin air-cell wall and in exchange takes on a supply of oxygen from the air breathed into the air cells. The discarded carbon dioxide and waste matter pass from the air cells in air breathed out of the lungs.

RESPIRATION AND THE MECHANICS OF BREATHING

Breathing is an act over which we exert little control. It occurs in the healthy adult about 12-16 times a minute when at rest but the rate per minute may be increased by exercise, labor, and a number of other causes. The amount of air entering and leaving the lungs during each respiration varies, as does the rate of breathing, according to whether the person is at rest or engaged in work or exercise. At rest adults breathe 25 to 30 cubic inches of air per respiration, whereas during strenuous effort the amount may be increased several times that breathed when at rest.

Breathing consists of two separate acts, inspiration, an enlargement of the chest cavity with a lowering of the pressure within the cavity, during which air is drawn into the lungs, and expiration, a lessening of the chest cavity and increasing of the pressure within the cavity, during which air is driven out of the lungs. In inspiration, which is chiefly a muscular act, the ribs are raised and the arch of the diaphragm falls and becomes flattened, thus increasing the capacity of the chest cavity, and tending to produce a vacuum causing air to enter. In expiration, an act performed with slight muscular action, the ribs fall to their normal position and the arch of the diaphragm rises, lessening the capacity of the chest cavity, and air is forced out. See Figure 19.

As all living tissues of the body depend for life on the oxygen carried by the blood, interference with breathing that reduces fresh supplies of oxygen to the blood produces a condition of oxygen want or asphyxia throughout the entire body.

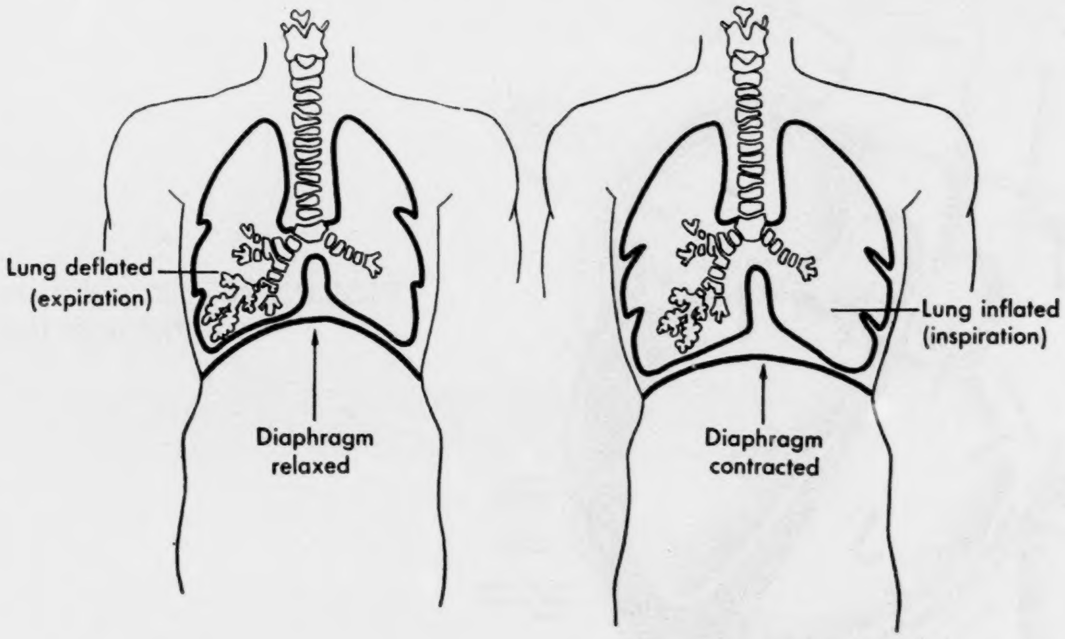


FIGURE 19. The difference in size of the chest cavity and lungs during expiration and inspiration

THE CIRCULATORY SYSTEM

INTRODUCTION

The circulatory system consists of the heart, the arteries, the veins and the capillaries. It is most interesting to note that this system contains approximately 60,000 miles of tubing through which it carries blood to all parts of the body. Regardless of the forces of gravity and the many thousands of different routes, circulation is constantly maintained, the arteries carrying blood away from the heart and the veins returning blood to the heart. The arteries branch into smaller arterioles which in turn branch into millions of minute capillaries. The capillaries unite into veins and return the blood to the heart. Before the blood is returned to the body, it circulates through the lungs where it deposits carbon dioxide and replenishes itself with oxygen. This entire circulatory cycle is completed in approximately 1-1/4 minutes.

THE HEART

The heart is a hollow muscular organ, approximately the size of your fist, located beneath the lower half of the sternum, between the two lungs, and just above the diaphragm. The heart is divided into a right and left side, between which there is no direct connection. Each side is further divided into an upper or receiving chamber (auricles), and the lower or pumping chambers (ventricles). Between each of the chambers there is a one-way valve that permits the blood to flow in one direction. In the normal adult, with the body at rest, the heart contracts at the rate of about 72 times per minute. See Figure 20.

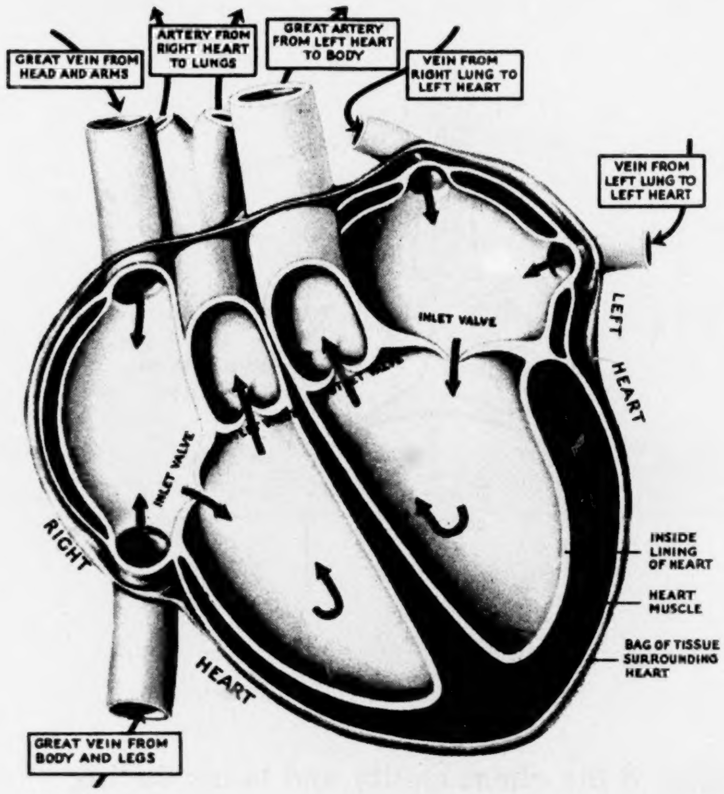

GREAT VEIN FROM HEAD AND ARMS
ARTERY FROM RIGHT HEART TO LUNGS
GREAT ARTERY FROM LEFT HEART TO BODY
VEIN FROM RIGHT LUNG TO LEFT HEART
VEIN FROM LEFT LUNG TO LEFT HEART
INLET VALVE
LEFT HEART
INLET VALVE
RIGHT
HEART
INSIDE LINING OF HEART
HEART MUSCLE
BAG OF TISSUE SURROUNDING HEART
GREAT VEIN FROM BODY AND LEGS

FIGURE 20. Circulation of blood through the heart

THE MECHANICS OF CIRCULATION

The circulatory system actually consists of two systems, pulmonary circulation and systemic circulation. With each contraction of the heart, blood is forced through each of these systems from the ventricles, likewise with relaxation of the heart blood fills the auricles.

Pulmonary Circulation. Blood is returned to the heart by two large veins that empty into the right auricle; from here it passes through a one-way valve into the right ventricle. Due to the contraction or pumping action, the blood is forced through the pulmonary artery to the lungs. In the lungs the exchange of carbon dioxide and other gases for oxygen takes place. The blood, now rich in oxygen, is returned to the left auricle through the pulmonary veins.

Systemic Circulation. From the left auricle the oxygenated blood passes through a one-way valve into the left ventricle. The left ventricle provides the necessary strong pumping action that forces the blood through the aorta. The aorta (the main artery of the body) subdivides to distribute blood to all parts of the body.

BLOOD

The blood consists of a fluid called plasma and two types of cells, red and white corpuscles. In one cubic millimeter of blood (one drop) there are approximately 5 million red corpuscles and approximately 7,000 white corpuscles. Red cells or corpuscles live only a few weeks and are continuously being replaced by new ones produced by red marrow of certain bones and the spleen. White blood cells serve in combating germs and in the removal of other harmful bodies. They do this by actually absorbing the harmful organisms into their own cells. White cells are produced by bone marrow, the spleen and the lymph nodes.

BLOOD VOLUME AND BLOOD PRESSURE

One twelfth to one fifteenth of the body weight is blood. A normal, average person, weighing 150 pounds, will have 10 to 12 pints of blood in his circulatory system.

Blood pressure is that pressure in the arteries that is created and maintained by the contraction or beating of the heart. A sufficient force is required to push the blood through the thousands of miles of blood vessels that make up the circulatory system.

PULSE

The pulse beat can be felt at various points on the body. Its beat corresponds to the contraction or beating of the heart. In the average adult the rate of beat is 72 times per minute, however, there may be variations of up to 5 beats per minute but usually never more than 5. In children a normal pulse rate is much faster, reaching up to 100 beats per minute.

In feeling for the pulse of a sick or injured person you must make an estimate of the following:

The speed - is it fast? - slow? - normal?

The strength - is it normal? - strong? - weak?

The rhythm - is it regular? - irregular?

THE CLOTTING MECHANISM

Nature provides a clotting mechanism that will physically plug a lacerated or severed blood vessel and stop bleeding that might prove to be fatal. This mechanism goes into action whenever blood flows over or through a rough spot in its lining. Almost immediately platelets floating in the blood break up and release a substance called thromboplastin which unites with prothrobin (a protein in blood) and calcium to form thrombin. It is the thrombin that causes fibrinogen (another protein in blood) to congeal and become fibrin. The fibrin forms a thread-like netting that catches the red blood cells, forming the clot and stopping the flow of blood. See Figure 21.

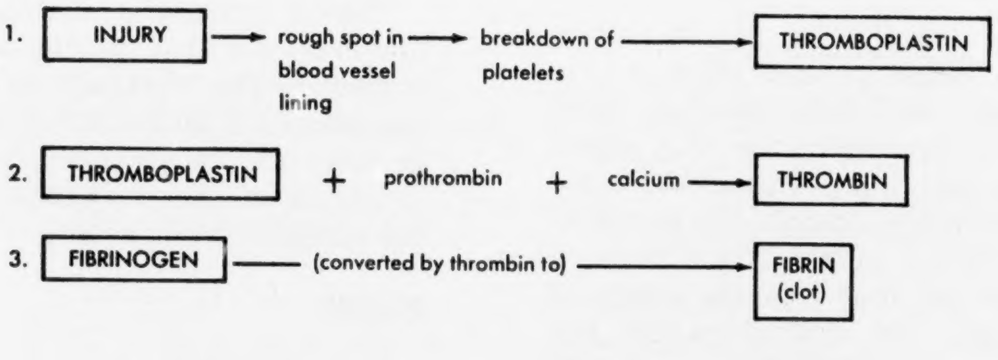

1. INJURY → rough spot in blood vessel lining → breakdown of platelets → THROMBOPLASTIN
2. THROMBOPLASTIN + prothrombin + calcium → THROMBIN
3. FIBRINOGEN — (converted by thrombin to) → FIBRIN (clot)

FIGURE 21. The main steps in blood clotting

LYMPH NODES AND THE SPLEEN

The lymphatic system is a part of the overall circulatory system. The lymph fluids come from the blood and return to the blood. In this circulatory process the lymph nodes filter from the blood injurious particles such as bacteria and other micro-organisms to prevent their further circulation throughout the body. Certain lymph nodes of persons with infections or cancer will swell and exhibit tenderness and pain. See Figure 22.

The spleen is located in the upper left part of the abdominal cavity, just below the diaphragm. Its true functions present much mystery and doubt. However, it is known that it produces blood cells and combats germs and bacteria. It can store up to two cups of blood that can be released very quickly into the circulatory system when needed, such as during vigorous exercise and after severe bleeding.

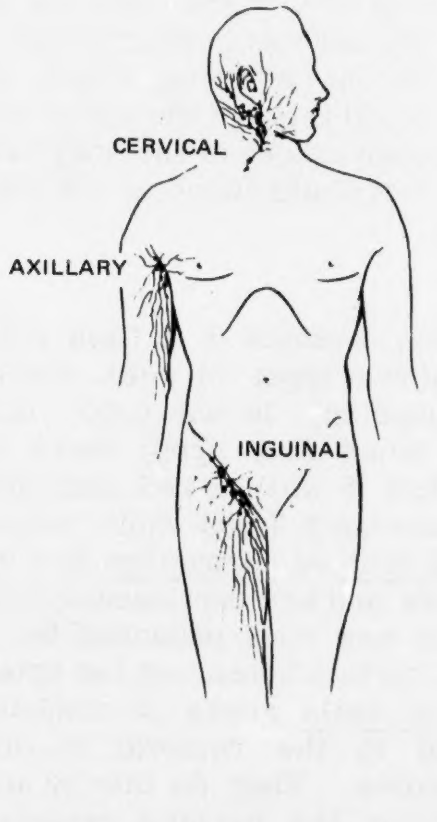

CERVICAL
AXILLARY
INGUINAL

FIGURE 22. Location of principal lymph nodes

THE DIGESTIVE SYSTEM

The digestive system consists of an open tube beginning at the mouth, and extending to its outlet, the anus. This tube connects the organs of digestion that include the mouth, pharynx, esophagus, stomach, small intestines, large intestines, and the anal canal. Accessory digestive organs include the teeth, tongue, salivary glands, liver, gallbladder, pancreas, and the appendix.

The digestive process comprises the intake of food, both solids and liquids, the preparation of the food mechanically and chemically for absorption of its useful products, and the elimination of waste and useless residue. See Figure 23.

THE STOMACH

After the food has been chewed and swallowed, it enters the stomach from the esophagus. The stomach is a pouch-like organ, not much bigger than a large sausage when emptied, but capable of considerable expansion after eating a large meal.

The lower part of the stomach is called the pylorus. The pylorus is a narrow section that connects with the first part of the small intestine (the duodenum). Food is held in the stomach by the pyloric muscle long enough for partial digestion. These muscles stay contracted most of the time to keep the opening to the duodenum closed. They relax at certain intervals when a portion of the food is ready to leave the stomach. The average meal remains in the stomach 3 to 6 hours before it is discharged into the duodenum.

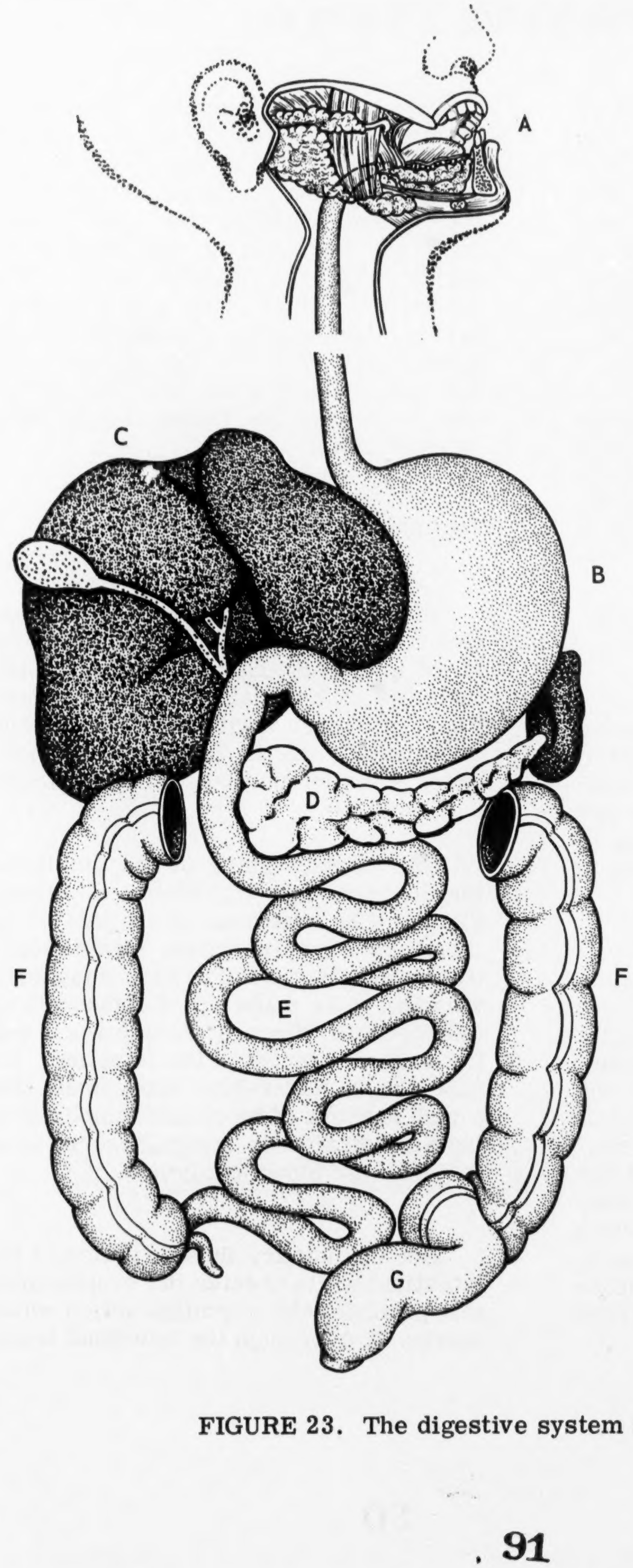
Muscle fibers running lengthwise, around, and diagonally in the stomach wall make it one of the strongest abdominal organs. These muscles are capable of breaking food into minute particles and mixing the food thoroughly with the gastric juice. The stomach is lined with mucous membranes that contain thousands of tiny glands that give off the gastric juice and hydrochloric acid. When the stomach is empty, its lining lies in folds called rugae.

THE SMALL INTESTINE

The small intestine is so named because it is smaller in diameter than the large intestine. The length of the small intestine is approximately twenty feet. There are three sections, the duodenum, the jejunum, and the ileum, named in the order in which food passes through them.

The mucous lining of the small intestine contains thousands of minute glands. The intestinal glands give off the intestinal digestive juice. Even though the lining of the intestine appears smooth, it is made up of thousands of microscopic "fingers" that project into the hollow interior of the intestine. Inside these finger-like structures lies a rich network of blood and lymph capillaries that affords faster absorption of food into the blood and lymph.

The involuntary muscle action of the intestinal walls creates the contractions that produces the wormlike action which moves food through the intestinal tract.



A. The mouth. Here the food is broken up into small particles (mastication) and mixed with saliva, which moistens the food for swallowing and begins the digestion of starch.

B. The stomach serves as a storehouse for food immediately after it is eaten. It produces an enzyme, pepsin, which, in the presence of hydrochloric acid, digests proteins. Mechanically it breaks up food into small particles and mixes it with gastric juice.

C. The liver produces bile, which neutralizes the acid food coming from the stomach, helps emulsify fats, and stimulates the action of the intestine.

D. The pancreas produces important enzymes for the digestion of proteins, carbohydrates and fats. Its secretion enters the intestine with the bile.

E. The small intestine (about 20 ft. long). Here the food is pushed slowly along and is kept thoroughly mixed with digestive juices by peristalsis. Digestion is completed here and most of the absorption takes place.

F. In the large intestine absorption of water takes place and bacteria act on the food mass, further digesting carbohydrates.

G. In the rectum the waste matter is concentrated for excretion.

FIGURE 23. The digestive system and organs involved

THE LARGE INTESTINE

The lower part of the digestive tract is formed by the large intestine. It is divided into the following sections: the cecum, ascending colon, transverse colon, descending colon, pelvic (sigmoid) colon, and the rectum. The rectum is approximately 7 to 8 inches long, and its external opening is called the anus. Two muscles stay contracted to keep the anus closed except during defecation. An involuntary muscle composes the inner anal action, but a voluntary muscle composes the outer. This explains the reason why victims of stroke or other paralytic conditions "run off the bowels." They lose complete muscle control of the anal area and have "involuntary defecations."

ACCESSORY DIGESTIVE ORGANS

The accessory digestive organs are those that help digest food but do not form part of the digestive tract itself.

The mouth serves several purposes. The teeth tear food apart; the tongue tastes it; the salivary glands lubricate the food, and, to a slight degree, helps to digest some starches.

The liver and gall bladder. The largest and most important gland in the body is the liver. It is located in the upper right hand section of the abdominal cavity and extends part way to the left side. One of its functions is to secrete bile which is a digestive juice. In addition, the liver helps to keep the amounts of sugar and proteins in the blood at normal levels.

The gall bladder is located on the undersurface of the liver. It serves as a place of concentration and storage of liver bile. When fats enter the duodenum, the gall bladder ejects bile into it to aid in the digestive process.

The pancreas is located behind the stomach. Some of its cells secrete pancreatic juice. This important digestive juice drains into the duodenum at the same place that the liver bile enters. Other cells of the pancreas secrete insulin into the blood. Insulin is a hormone necessary for maintaining a normal amount of blood sugar.

The appendix is a wormlike tube off of the secum. It serves no known purpose, but it causes much trouble when its mucous lining becomes inflamed. We are all familiar with this affliction called appendicitis.

DIGESTION

All of the aforementioned organs work together to perform the function called digestion. Basically, digestion is the changing of foods into substances that can be absorbed through the mucous membrane lining of the small intestine, passing them on into the blood and eventually on to all the cells of the body.

This involves both mechanical and chemical processes.

The mechanical processes include chewing, swallowing, and peristalsis. Peristalsis is the rhythmic, wavelike motion of the stomach and intestinal walls that break food into minute particles and mixes them with digestive juices and moves them along the digestive tract.

The chemical processes are many. Food molecules that are too large for absorption are broken down by chemical reactions of the digestive enzymes into smaller molecules which can easily pass through the intestinal walls into the blood.

Protein digestion starts in the stomach and is completed in the small intestine. Proteins are the "tissue-building foods."

Carbohydrate digestion takes place mainly in the small intestine. Carbohydrates and fats are the "energy foods."

THE URINARY SYSTEM

The urinary system consists of the kidneys, the ureters, the urinary bladder, and the urethra. Their purpose is to form and remove urine from the body. In doing so, they maintain the body's water balance or water chemistry. Among the most principal wastes removed by the urine are substances that contain nitrogen. If this was not removed, it could build up at an alarming rate and create a dangerous toxic condition.

The kidneys lie behind the abdominal organs, on either side of the vertebral column. The left kidney is usually a little larger than the right kidney and a little farther above the waist.

The blood circulating through the kidneys permits them to filter out water and other dissolved substances. However, due to certain kidney diseases and heart disease, the kidneys may not excrete normal amounts of urine. The normal urine output is a little more than a quart per day.

Perched atop each kidney are the adrenal glands. The adrenals secrete many important hormones and have much to do with the actions and reactions of the body during periods of great pyschological pressure.

Urine leaves the kidneys through the ureters. The ureters are thick fibrous tubes that run downward along the muscles covering the spinal column and empty into the urinary bladder.

The urinary bladder is a thick muscular organ located deep in the pelvis. The muscular expansion permits the bladder to hold variable amounts of urine and then being able to contract to expel the urine. Most people get the urge to urinate when the bladder contains about 1/2 pint of urine.

The bladder empties itself through the urethra. In women the urethra is about 1-1/2 inches long, but in men it will be approximately 8 inches long. The urethra is the lowest point of the urinary system and the organ that permits the urine to leave the body. See Figure 24.

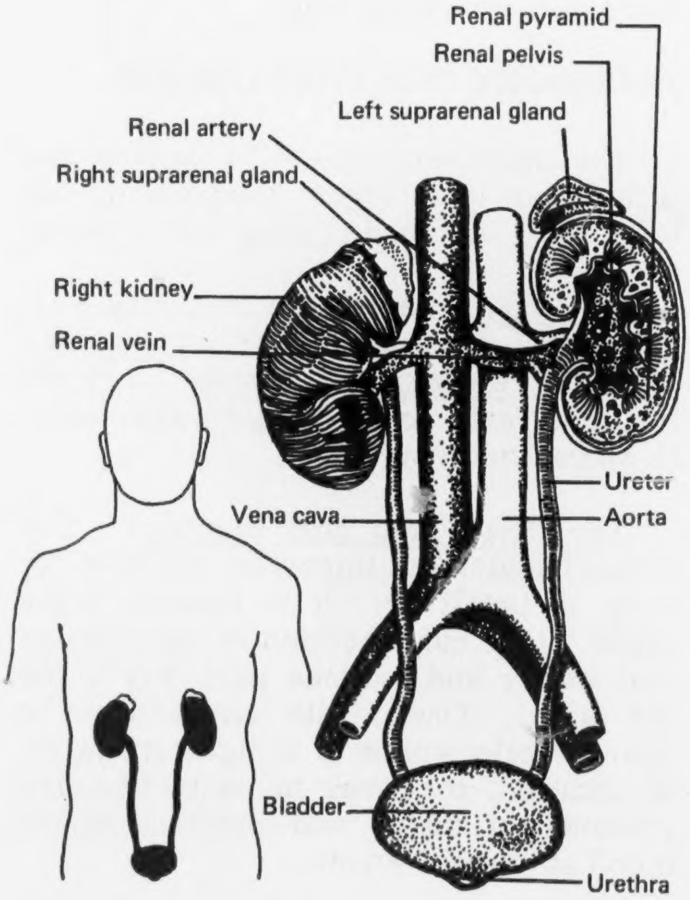


FIGURE 24. The organs of the urinary system

THE REPRODUCTIVE SYSTEM

The male reproductive system consists of four major divisions: (1) the main sex glands, (2) the ducts, (3) accessory sex glands, and (4) the external genitalia.

The main sex glands are the testicles. They produce the sperm cells which eventually unite with the female sex cell (ovum). There are millions of sperm cells in each ejaculation, yet only one will succeed in fertilizing the ovum. The testicles secrete a fluid (semen) to carry the sperm through the many ducts to its destination.

The ducts begin at the testicle where the sperm enters into a narrow tube which is about 20 feet long, tightly coiled and lies on top of the testicle. Following the diagram, Figure 25, we can trace the path of the semen through the seminal duct, the ejaculatory duct, and finally the urethra.

The accessory sex glands are the seminal vesicle, the bulbourethal and the prostrate. Their function is to inject an alkaline secretion to the semen to permit the sperm cells to live and remain fertile. Sperm cells survive much longer in an alkaline fluid than in an acid one.

The external genitals consist of the scrotum and the penis. The scrotum is the pouch or sac that contains the testicles. The penis is the male organ that places the sperm within the female. It is made up of a special kind of tissue that contains many small spaces that are usually collapsed. Under sexual stimulation, blood floods these small spaces, expanding them enough to cause enlargement and rigidity of the organ.

The female reproductive system is similar to the male inasmuch as it consists of four major divisions: (1) the

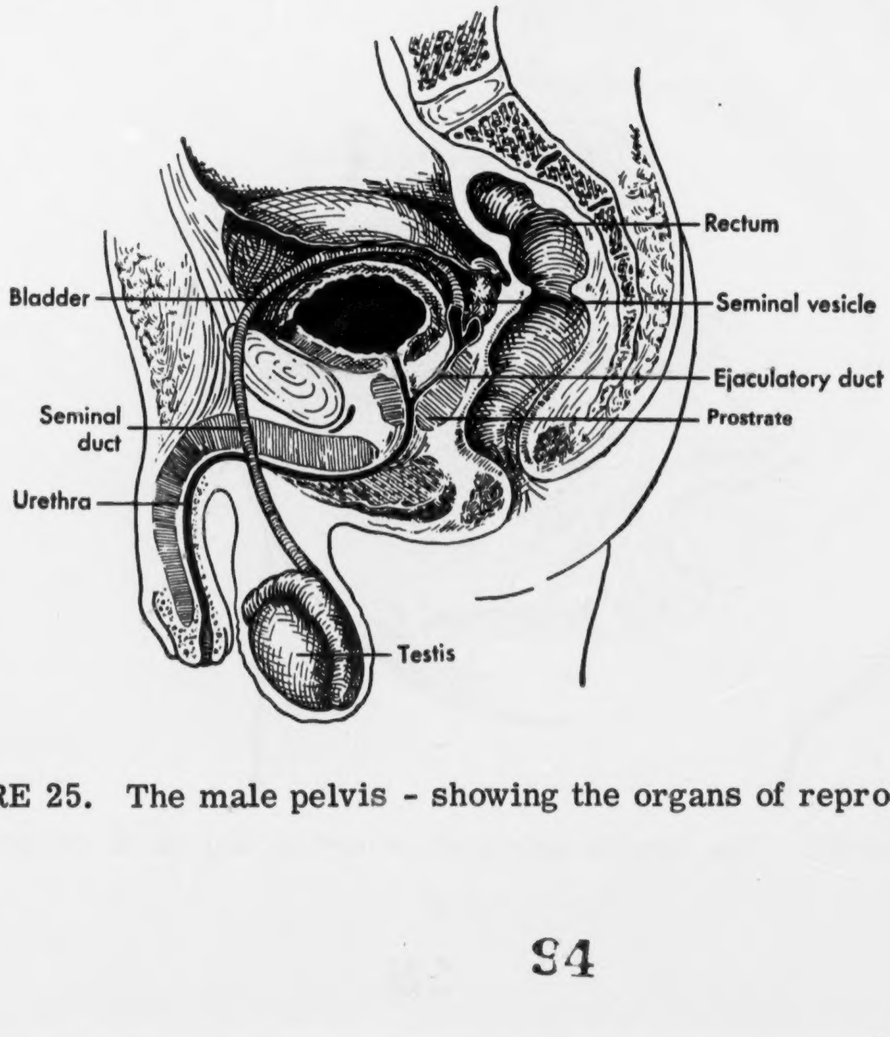


FIGURE 25. The male pelvis - showing the organs of reproduction

main sex glands, (2) the ducts, (3) the accessory glands, and (4) the external genitals.

The main sex glands are the ovaries. They are located in the pelvic cavity and are made up of thousands of little sacs. Within each of these little sacs lies an immature ovum (female sex cell). One ovum matures each month and is ejected into the pelvic cavity. This is called ovulation.

The ducts consist of the fallopian tubes, the uterus, and the vagina. The fallopian tubes serve as a passage to carry the ovum from the pelvic cavity to the uterus. Each tube is approximately 4 inches long and is connected directly to the uterus, but not to the ovaries. The uterus is a muscular pear-shaped organ approximately 3 inches long, 2 inches wide and 1 inch thick. During pregnancy this organ will expand and be capable of holding a baby plus a considerable amount of fluid. During ovulation the ovum passes through the fallopian tube to the uterus. If the ovum is united with the sperm cell, fertilization occurs and the united cells will imbed themselves in the prepared uterine lining to grow into the fetus. However, if fertilization does not occur, the uterus will cleanse itself of the unfertilized ovum and the prepared lining through an act called menstruation, and expel this with some blood through the vagina and out of the body. The vagina is that part of the female reproductive tract that opens to outside of the body. It is the organ that receives the sperm on its journey to meet an ovum. The vagina is also a passageway for the birth of a baby. See Figure 26.

The accessory glands are the Bartholin glands located near the vaginal opening.

The external genitals consist of the many parts of the vulva and the entrance to the vagina.

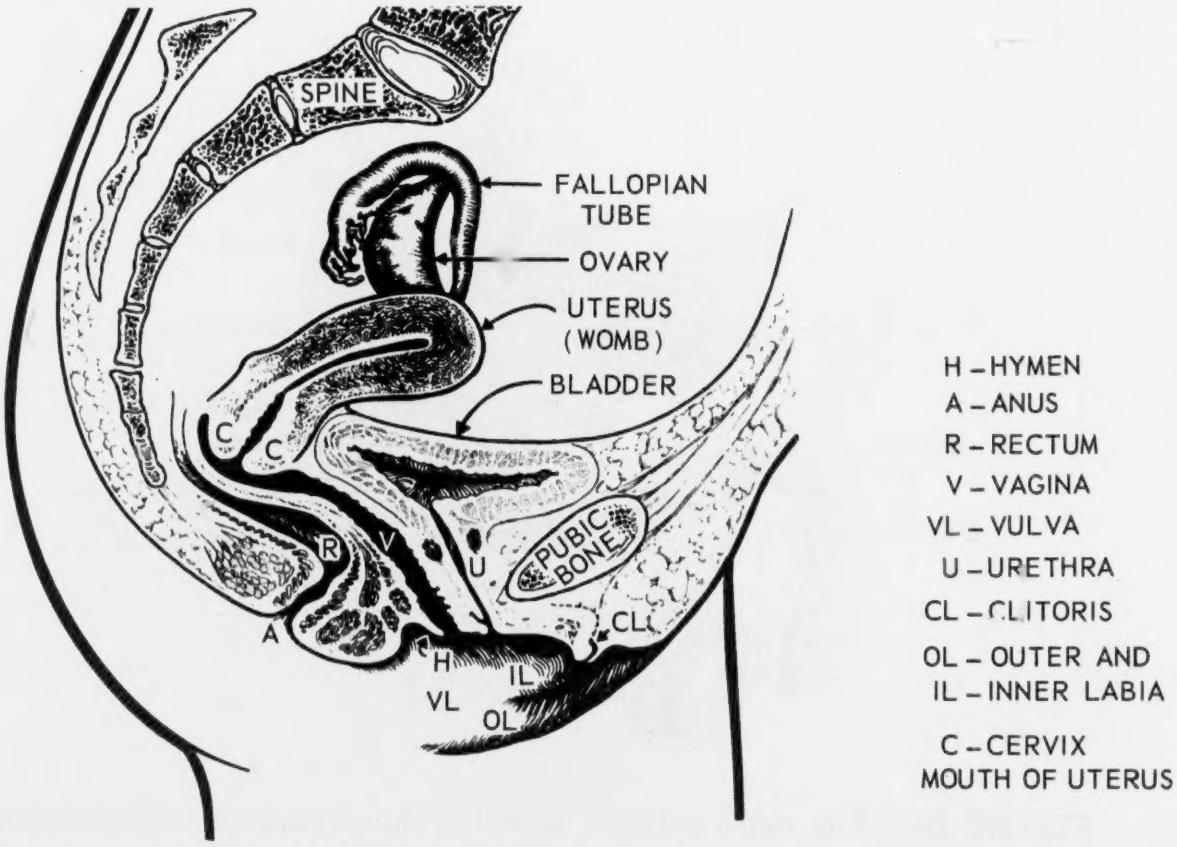


FIGURE 26. The female pelvis showing the organs of reproduction

THE ENDOCRINE SYSTEM

The endocrine system is composed of glands that produce one or more hormones that regulate and control certain functions of the body. It can be said that the endocrine system works similar to the nervous system in its functions of communication and control. The nervous system sends nerve impulses by way of nerve fibers in order to regulate their activities. The endocrine system performs its job of regulation and control by sending hormones through the circulating blood. The organs of the endocrine system consist of the pituitary gland, the thyroid gland, the parathyroid gland, the adrenal glands, the islands of langerhans, the female sex glands, and the male sex glands. See Figure 27.

The Pituitary Gland is an organ no larger than a pea. It is attached to the central part of the floor of the brain and is protected by bony structure. Some of its main functions are the stimulation of growth, the stimulation of other glands such as the thyroid, adrenals, testicles, ovaries, and breasts. It also gives off a hormone that speeds up the kidney in the absorption of water. The pituitary holds a position of great importance. Its location at the floor of the brain certainly indicates this.

The Thyroid Gland is located in the neck just below the larynx. The hormone that is secreted by the thyroid speeds up the release of energy from foods. If the thyroid secretes too much hormone, the release of food energy speeds up too much. This causes some individuals to appear nervous and overactive.

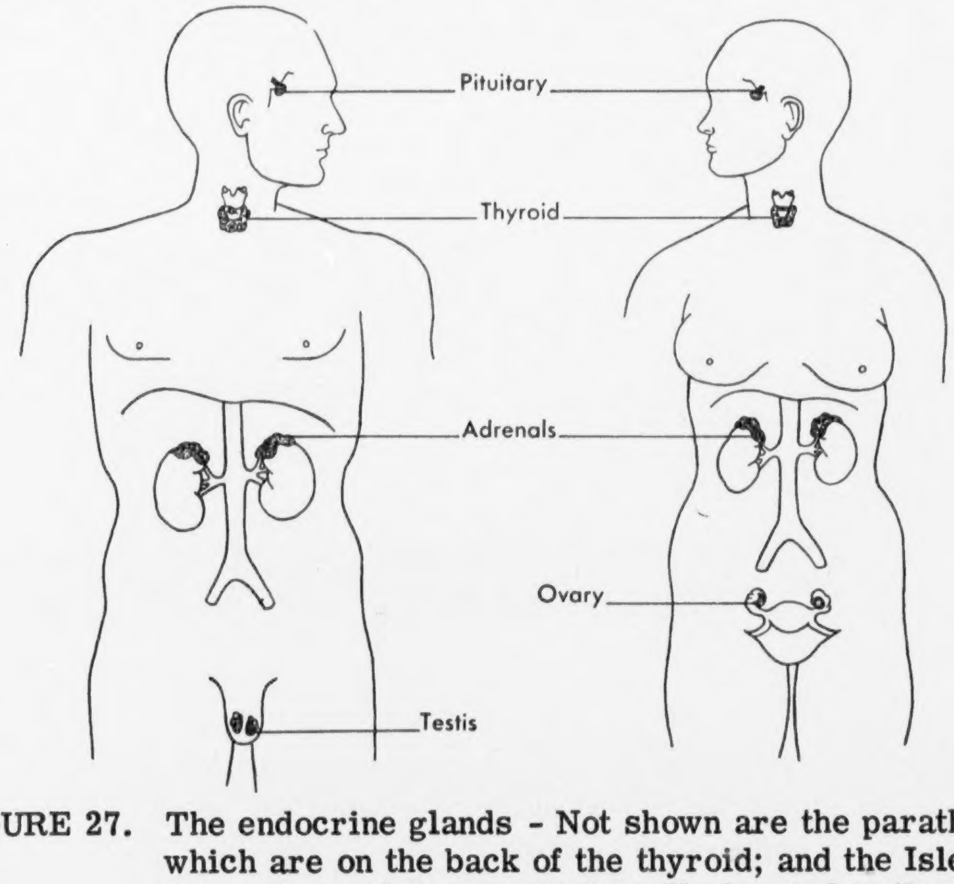


FIGURE 27. The endocrine glands - Not shown are the parathyroids which are on the back of the thyroid; and the Isle of Langerhans that are minute cells located in the pancreas.

The Parathyroid Glands are very small and are located on the back of the thyroid. Its main function is to give off the hormone that controls the chemistry of the blood. It allows calcium to leave the bones and enter the blood, and increase blood calcium. This is a very important function for brain cells and heart cells cannot perform their task if the blood calcium is too low or too high. This gland must maintain a proper blood calcium balance at all times.

The Adrenal Glands are located on the top of each kidney. Each gland is composed of two parts. The adrenals give off hormones that assist in increasing glucose in the blood, to increase blood sodium and decrease blood potassium. From the inside of the adrenals is secreted the hormones that help prepare the body for emergencies of all kinds.

The Islands of Langerhans are minute clusters of cells that are located in the pancreas. These are the only glands in the body that cannot be seen with the naked eye. They are, as the name implies, little clumps of cells scattered throughout the pancreas like islands in the sea. The hormone that is secreted is insulin. Insulin's exact action is a mystery, but it has been established that it does permit blood sugar to be absorbed through the cell and to be used as energy by the body. A malfunction of this gland produces a condition called diabetes.

The Female Sex Glands, the ovaries, secrete not only the ovum, but hormones that control ovulation and menstruation.

The Male Sex Gland, the testicles, produces the sperm, plus hormones that develop the male sex organs and other male characteristics.

CHAPTER IX

PROPER EXAMINATION

INTRODUCTION

Before the squadman can administer emergency care, he must make a rapid, but thorough, examination of the victim to determine the extent of life-threatening injuries, and to take necessary supportive action. A survey must then be made for additional nonthreatening injuries, administer necessary emergency care, and prepare the victim for safe transportation to the hospital.

PRIORITY OF EMERGENCY CARE

Absence of breathing must be considered the number one emergency and the squadman will exert every effort to establish an open air passage and to ventilate the victim immediately. Once breathing has been established, all bleeding must be controlled, followed by the treatment for shock.

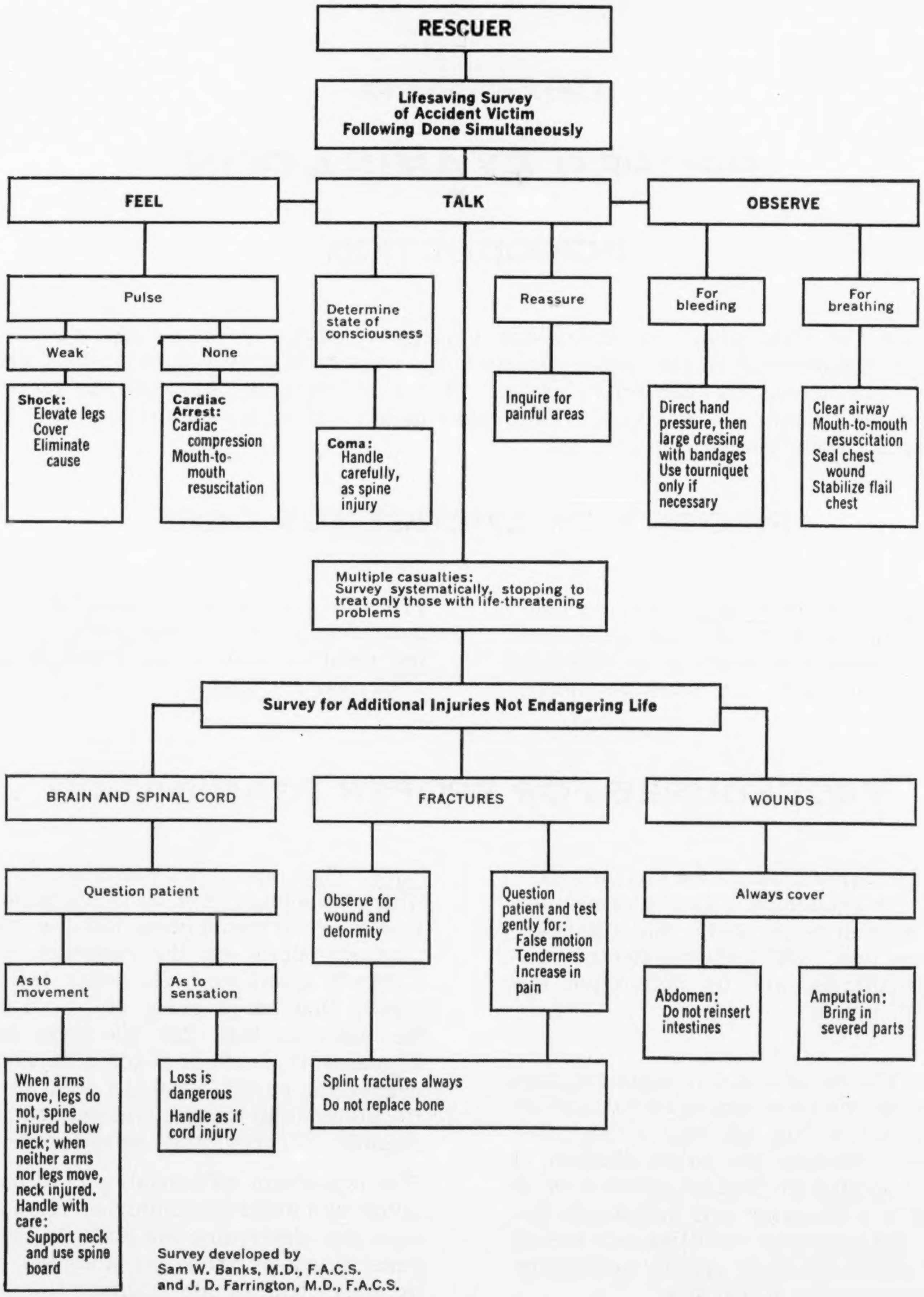
PROCEDURES FOR PROPER EXAMINATION

To properly evaluate the victim's condition, the squadman will utilize as many of his senses as possible. See Chart #1. He must feel, talk, and observe the victim simultaneously to determine the extent of injury.

Feel: The squadman can to some degree determine the presence of respiration by feeling below the rib cage at the diaphragm. Feeling the pulse; absence of pulse indicates no circulation and cardiac arrest, a weak pulse will indicate shock. Gently feeling the extremities may reveal slight deformities or grating sensations that will indicate a fracture.

Talk: The squadman will talk to the victim, reassuring him as to his problem. Under no circumstances will the squadman speculate on the outcome of the victim's condition. He never tells the victim that he is going to be all right. He assures him that the help he so desperately needs is at his side, and that everything possible will be done for him. He states that he is a trained squadman capable of providing emergency care.

The squadman will inquire as to painful areas and other discomforts. The squadman can determine the state or level of consciousness from the answers given by the victim, or his attempts to answer.


RESCUER
Lifesaving Survey of Accident Victim Following Done Simultaneously
FEEL
TALK
OBSERVE
Pulse
Weak
None
Shock: Elevate legs Cover Eliminate cause
Cardiac Arrest: Cardiac compression Mouth-to-mouth resuscitation
Determine state of consciousness
Coma: Handle carefully, as spine injury
Reassure
Inquire for painful areas
For bleeding
Direct hand pressure, then large dressing with bandages Use tourniquet only if necessary
For breathing
Clear airway Mouth-to-mouth resuscitation Seal chest wound Stabilize flail chest
Multiple casualties: Survey systematically, stopping to treat only those with life-threatening problems
Survey for Additional Injuries Not Endangering Life
BRAIN AND SPINAL CORD
FRACTURES
WOUNDS
Question patient
As to movement
As to sensation
When arms move, legs do not, spine injured below neck; when neither arms nor legs move, neck injured. Handle with care: Support neck and use spine board
Loss is dangerous Handle as if cord injury
Observe for wound and deformity
Question patient and test gently for: False motion Tenderness Increase in pain
Splint fractures always Do not replace bone
Always cover
Abdomen: Do not reinsert intestines
Amputation: Bring in severed parts

Survey developed by
Sam W. Banks, M.D., F.A.C.S.
and J. D. Farrington, M.D., F.A.C.S.

CHART 1. Procedures for examination

Observe: While feeling and talking, the squadman is simultaneously observing the victim. He looks for bleeding, deformities of a body part, and will constantly observe the victim for changes in respiration, color, restlessness, and signs of nausea. He will look for possible loss of sensation or function that may indicate a neck or spine injury. A scan of the accident site can indicate the cause of injury and lead to additional suspicions of the victim's condition.

UNCONSCIOUS PERSONS

DEFINITION

Unconsciousness is the state of being insensible or without conscious experiences.

CAUSES

To describe here all the causes of unconsciousness is not feasible; they are too many and too complex.

ESSENTIAL POINTS TO REMEMBER

1. The air passage is usually poor at some time during the illness.

2. The inhaling of any foreign material may cause death.

    a. Check closely for any foreign material in the patient's mouth.

    b. Check closely for any vomiting which may bring foreign material to the mouth from the stomach.

3. Since a state of unconsciousness means that all body functions are impaired, respiration may be slower.

4. Always remember that the unconscious person is breathing, while the asphyxiated person is unconscious and not breathing.

5. Check the victim for a medical identification symbol. See Chart 2.

SQUADMEN'S CARE

Check the victim for any difficulty in air exchange. If difficulty is noted, you must do the following:

1. Check his air passage. If a good air passage is needed, the squadman must insert a plastic, hard rubber, metal or improvised airway immediately. This will keep the paralyzed tongue out of the way of the windpipe. The unconscious person can still have a gag reflex. If there should be any sign of gagging on the airway, remove it immediately. Do not cause the complication of vomiting with the airway. The squadman can then lift up on both sides of the angle of the jaw to create a good air passage.

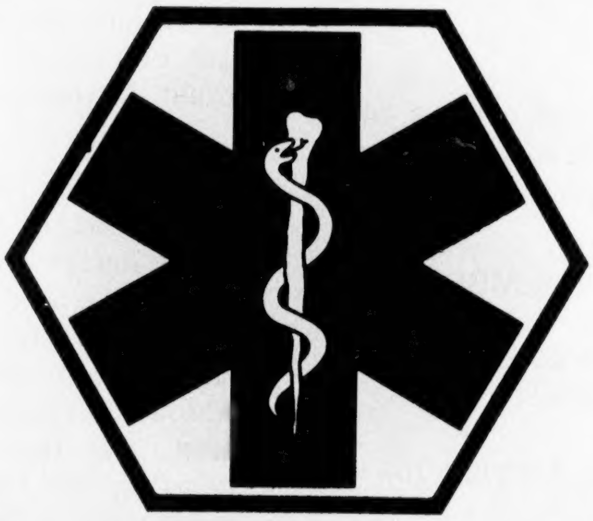
2. If there is any sign of vomiting or coughing up of any foreign material, the victim must be turned on his side immediately. This will facilitate the flow of any foreign materials out of the mouth.

3. It is always a safe practice to support these people with a flow of oxygen. If they should stop breathing, resuscitate them.

MULTIPLE VICTIMS

In the event of a large scale disaster, or any accident having several victims, the squadmen must sort (triage) the victims with the maximum effort being exerted to do the most good for the greatest number. In some cases the entire group can be surveyed simultaneously and the squadmen will stop to treat only those that exhibit life-threatening emergencies.

EMERGENCY MEDICAL IDENTIFICATION



RECOGNIZE THIS SYMBOL

This universally recognized symbol is worn or carried by many thousands of people who have pre-existing health problems which may cause or complicate emergency situations. Watch for it.

If you see this symbol, look in the patient's wallet for information about his specific medical condition and be sure to notify hospital emergency personnel.

CHART 2. The universally recognized medical alert symbol

CHAPTER X

"AIRWAY MAINTENANCE AND RESUSCITATION"

Resuscitation is a general term which covers all of the measures taken to restore life or consciousness. These measures include artificial respiration (both manual and mechanical) to restore breathing, and closed chest heart compression to restore circulation. This chapter will present the manual and mechanical methods of artificial respiration, and Chapter II will cover the necessary procedures for closed chest heart compression.

STOPPAGE OF BREATHING

Stoppage of breathing (apnea) causes the condition known as asphyxia which is the inability or failure of the lungs to absorb oxygen and to give off carbon dioxide. As a result there is insufficient oxygen supplied to the body (hypoxia) and a build-up of carbon dioxide and waste products in the blood and tissue cells. Asphyxia may result from blockages of the air passages by vomitus, blood, food, or foreign bodies. Victims who have inhaled super heated air, live steam, smoke, or irritating gases may stop breathing due to swelling of the mucous membranes of the respiratory tract or increased secretion of fluids. Poison gases and certain diseases may paralyze the breathing muscles; lightning and electric shock may paralyze the breathing control center in the brain or it may cause ventricular fibrillation, a form of irregular heartbeat which is usually fatal.

MANUAL ARTIFICIAL RESPIRATION

Throughout history many types of artificial respiration have been used, and each in their own time were accepted. In general, all of these methods fall into two classes: "Push -Pull" (back pressure, arm lift; back pressure, hip lift; chest pressure, arm lift), and "rocking" (eve rocking method and other variations of the rocking principle). These methods are not effective because the rescuer is unable to maintain a free and open air passage. In addition, there is no way for the rescuer to know whether or not the air passage is open or blocked while administering artificial respiration.

In recent years, mouth-to-mouth resuscitation has been received with great enthusiasm. This method was first recommended for infants and small children, but, because of its great success in this age group, it came to be recommended for adults. As a result of the interest generated, extensive studies were make to evaluate all methods of manual artificial respiration. These studies resulted in unquestionable proof that mouth-to-mouth is superior to all other methods of manual artificial respiration regardless of age, or size of the victim. It is now recognized as the method of choice.

The following information was obtained from the extensive studies undertaken:

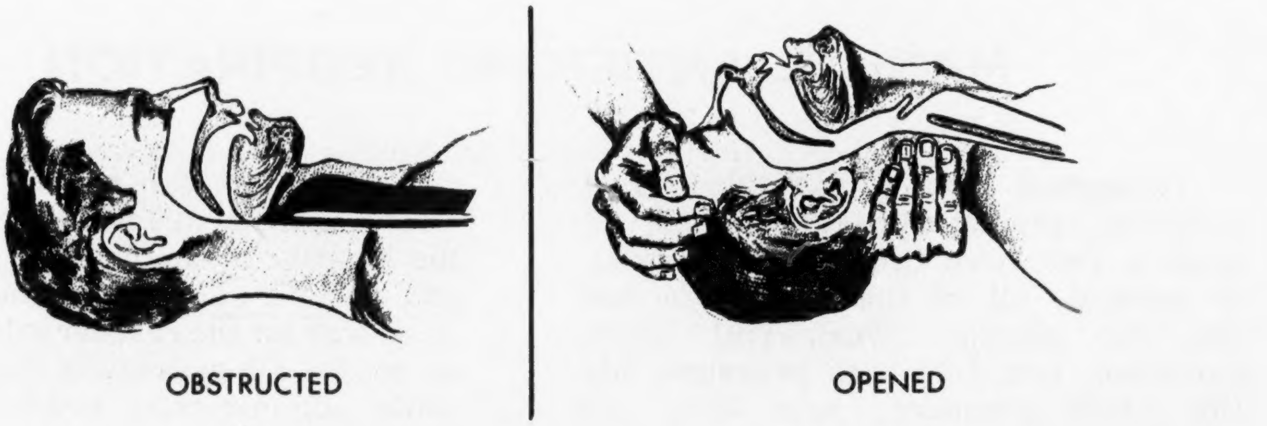
1. The first consideration in any method of artificial respiration is that the air passageway be open; otherwise it is impossible for any air to get into the lungs, regardless of the method used. The air passageway of the unconscious victim is blocked when the neck is bent (chin on chest). The air passageway can be maintained open by holding the chin extended (sniffing position) and by holding the lower jaw forward, or to raise the neck and tilt the head back as shown in Figure 1.

2. Mouth-to-mouth resuscitation is superior to all other manual methods of artificial respiration.

3. A pocket-sized S-shaped breathing tube (mouth-to-mouth airway) eliminates the direct mouth-to-mouth contact, and makes mouth-to-mouth breathing more acceptable.

4. Mouth-to-mouth and mouth-to-airway breathing can move breaths of 1000 to over 2000 cc of air because (a) the rescuer's hands can hold the victim's head in the "sniffing position" and can support the victim's lower jaw, thus providing an open air passageway, (b) the rescuer can watch the victim's chest and listen to the victim's expirations from which he can determine with each breath whether or not any air is entering the lungs, and, (c) the air can be moved with enough force so that adequate amounts can be moved into the lungs even in obese victims.

5. Untrained rescuers can perform mouth-to-mouth and mouth-to-airway breathing successfully if certain technical details described in this manual are observed.



OBSTRUCTED

OPENED

FIGURE 1

Some people may wonder how air which has been "used" by the lungs of one person will be any good in artificial respiration. Although the air which the rescuer exhales after a normal breath has slightly less oxygen and more carbon dioxide than the air which he inhales, there is enough oxygen remaining in the rescuer's exhaled air to keep the non-breathing victim alive. During mouth-to-mouth breathing, the rescuer is breathing more deeply than normally. As a result of his deep breathing (1) the air which the rescuer blows into the victim's lungs is as good as room air and (2) in addition, the victim receives breaths of a greater volume than he normally breathes. The breaths are usually so large that the oxygenation of the victim and the removal of carbon dioxide from the victim are greater than when he is conscious and breathing on his own.

RESCUE OF THE UNCONSCIOUS VICTIM

OUTLINE OF METHOD

When the unconscious victim does not breathe, or when he appears to be breathing but his air passageway is blocked (for instance, because his head is not held in the "sniffing position"), his brain dies from oxygen lack within minutes. Therefore, when a victim is found, act within a matter of seconds as follows:

1. Positioning the Victim and Clearing his Throat - Place the unconscious victim on his back, as you must be able to see his face. Move an injured victim cautiously. If there is foreign matter (for instance, vomit) visible at the mouth, clear the mouth and throat. (See Figure 2.) If no foreign matter is visible, proceed immediately to step 2.

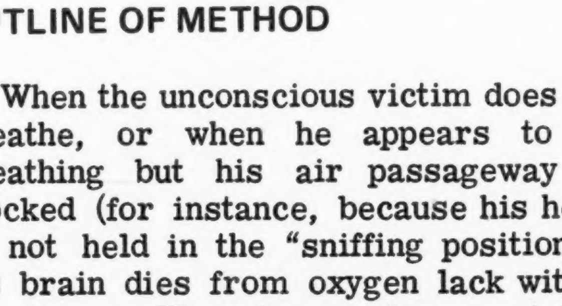


FIGURE 2. Clearing the victim's mouth and throat

2. Opening the Air Passageway (Figure 3A, 3B, or 4) - Place the vitim's head in the "sniffing position" and keep his lower jaw upward. Figure 3A-3B shows the methods that are preferred. Figure 4 is the alternate method to be used when the victim's mouth cannot be opened.

If the victim appears to be breathing naturally, maintain the support of his air passageway until he wakes up. (See Figures 3 and 4.) When he appears to be breathing naturally, but his tongue is blue or gray rather than pink, start mouth-to-mouth assisted breathing immediately.

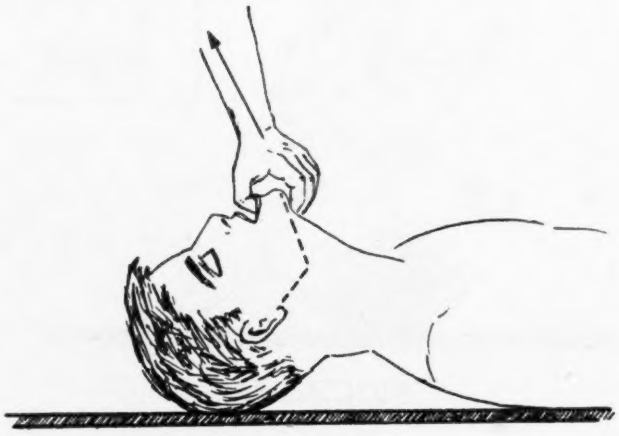


FIGURE 3A. Bringing jaw forward ("claw hand")

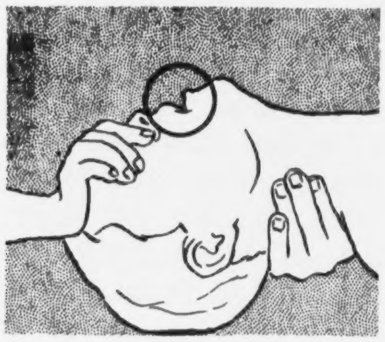


FIGURE 3B. Lifting the neck to open the air-passage

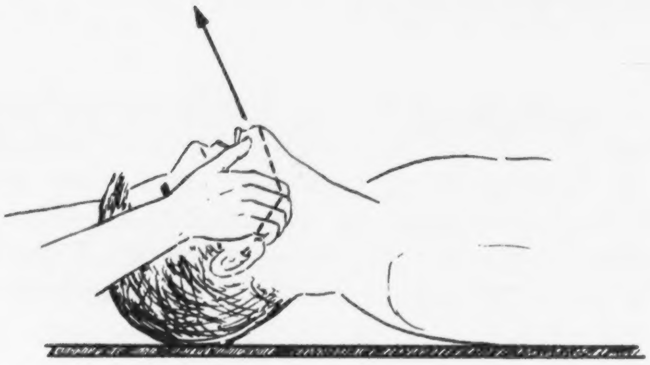


FIGURE 4. Bringing jaw forward (alternate)

3. Artificial Respiration - When the victim is not breathing (chest and abdomen not moving) start mouth-to-airway or mouth-to-mouth breathing immediately and continue until the victim starts breathing naturally or a doctor pronounces him dead.

If you are carrying a mouth-to-mouth airway, use mouth-to-airway breathing in both child and adult.

If you are not carrying a mouth-to-mouth airway, use the preferred mouth-to-mouth method as shown in Figure 5A or 5B.

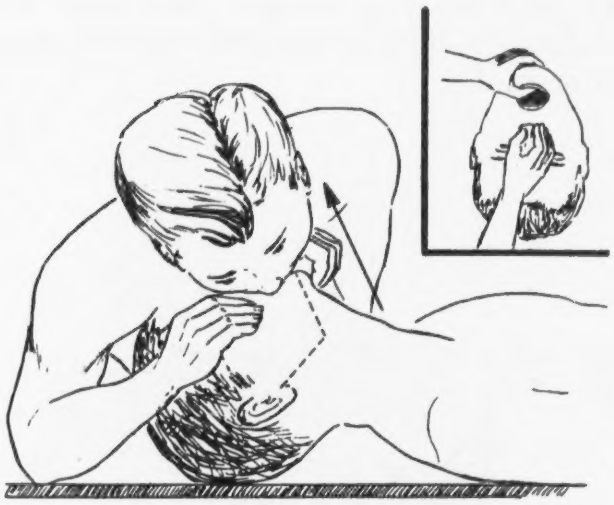


FIGURE 5A

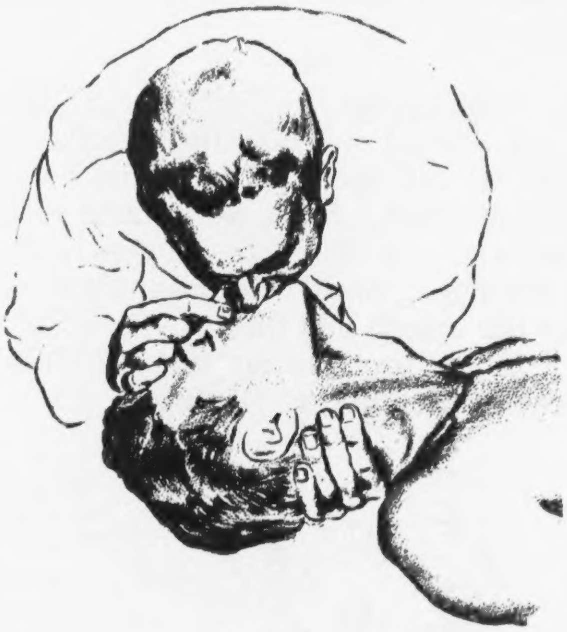


FIGURE 5B

The "claw hand" (Figure 5A) affords the maximum lift of the lower jaw; however the hand lifting the neck (Figure 5B) is easier to apply and in most cases will provide an adequate open air passage.

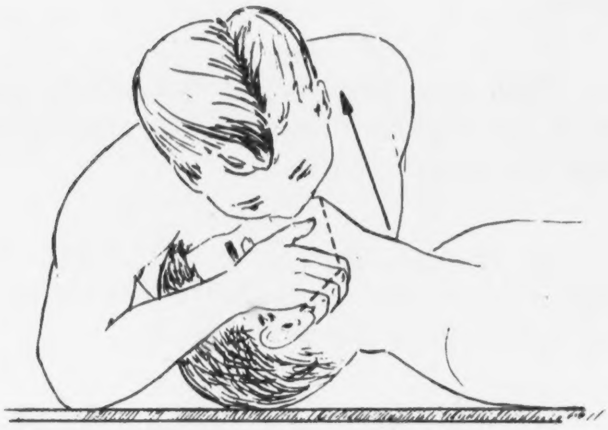


FIGURE 5C. Position of rescuer's hands and mouth on the victim (alternate) for some children and adults.

POSITIONING THE VICTIM AND CLEARING HIS UPPER AIR PASSAGE

1. Place the victim on his back (supine). Move injured victim cautiously.

2. Remove foreign matter from the upper air passage. If foreign matter (vomit, blood, phlegm, etc.) is visible in the victim's mouth, turn his head to the side, force his mouth open, and quickly wipe out his mouth and throat with your fingers or a piece of cloth (Figure 2).

You should not spend more than a few seconds doing this, as little time should be lost in getting air into the victim's lungs. If the mouth appears clean, start mouth - to - airway or mouth-to-mouth breathing at once. Whenever it seems necessary, you may repeat the cleaning procedure after either mouth-to-airway or mouth to -mouth breathing has been started.

OPENING THE AIR PASSAGEWAY

PREFERRED METHOD

1. Place the head in the "sniffing position" (Figure 3A or 3B). Place the head as far back as possible, so the neck is extended. The chin must "lead" and the front of the neck must be stretched.

2. Hold the lower jaw up (Figure 3).

a. Approach the victim's head from either side.

b. Insert the thumb of your left hand between the victim's teeth and grasp his lower jaw at the midline (Figure 3A).

c. Lift the lower jaw forcefully upward so that the lower teeth are higher than the upper teeth, or raise the neck and tilt the head back (Figure 3B).

d. Hold the head in this position as long as the victim is unconscious.

ALTERNATE METHOD WHEN THE VICTIM'S MOUTH CANNOT BE OPENED

1. Place the head in the "sniffing position" (Figure 4). Place the head as far back as possible, so the neck is extended. The chin must "lead" and the front of the neck must be stretched.

2. Hold the lower jaw up (Figure 4.)

a. Approach the victim's head from his side.

b. With both hands grasp the angles of the lower jaw just beneath the ear lobes.

Lift the lower jaw forcefully upward so that the lower teeth are higher than the upper teeth.

d. If the lips are shut, pull the lower lip down gently with the thumbs, but never drop the chin.

e. Hold the jaw in this position as long as the victim is unconscious.

MOUTH-TO-MOUTH BREATHING

PREFERRED METHOD

1. Open the air passageway as shown in Figure 3A or 3B.

2. Blow air into the lungs (Figure 5A -5B).

a. Close the victim's nose with your free hand.

b. After taking a deep breath, place your mouth over the victim's mouth with airtight contact. Do not hold the victim's mouth open widely, as you must take the entire mouth of the victim inside your lips.

c. Blow into the victim's mouth. Blow forcefully into adults and gently into children.

d. While blowing, watch the victim's chest. When the chest rises, stop blowing and quickly remove your mouth from the victim's mouth.

e. Let the victim exhale passively by the elasticity of his lungs and chest.

f. When the chest does not rise, improve the support of the air passageway (1) and blow more forcefully.

g. Repeat these inflations 15 to 20 times per minute.

ALTERNATE METHOD

(For children under three years or for any victim whose mouth cannot be opened.)

1. Open the air passageway as shown in Figure 5C.

2. Blow air into the lungs (Figure 5C).

a. After taking a deep breath, place your mouth over the victim's mouth with airtight contact. Cover the nose with your right cheek in order to prevent air leakage. In a baby, cover both the mouth and nose with your mouth.

b. Blow into the victim's mouth. Blow forcefully into adults and gently into children. In a baby, blow only with small puffs from your cheeks, not from your lungs, to prevent damage to the baby's lungs.

c. While blowing, watch the victim's chest. When the chest rises, stop blowing and quickly remove your mouth from the victim's mouth.

d. Let the victim exhale passively by the elasticity of his lungs and chest.

e. When the chest does not rise, improve the support of the air passageway (1) and blow more forcefully.

f. Repeat these inflations 15 to 20 times per minute.

MOUTH-TO-AIRWAY BREATHING

This is the method of choice if you are carrying mouth-to-mouth airways. There are two sizes of airways available:

a. Combined child-infant size

b. Combined adult/large-child size The size of the victim determines which one to use and which end is inserted into the mouth (Figure 6).

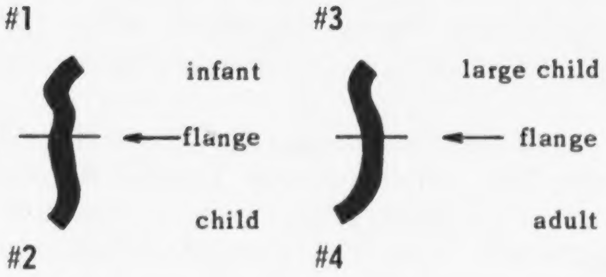


FIGURE 6. Mouth-to-mouth airways. Note two sizes on each.

BASIC METHOD

1. Insert the airway (Figure 7).

a. Approach the victim from the top of his head (vertex).

b. Force the mouth open with one hand.

c. Insert the proper end of the airway over the tongue following the contour of the roof of the mouth until the flange comes to rest at the victim's lips. Do not push the tongue back into the throat. If the tongue is in the way, push its base forward with the finger. If the victim is an adult, insert the long end of the large airway (#4); if he is a large child, insert the short

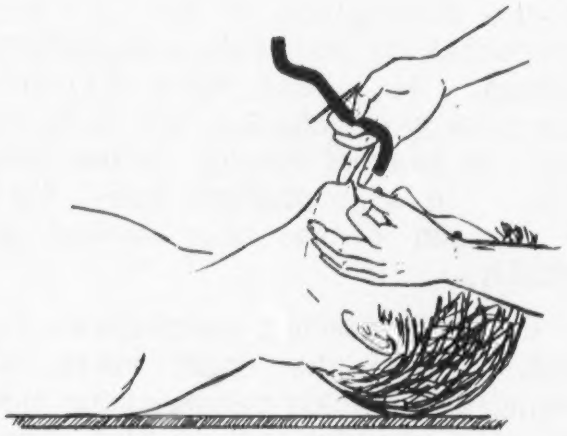


FIGURE 7. Inserting the airway

end of the large airway (#3); if he is a small child or a baby, insert the short end of the small airway (#1). The part of the airway which remains outside serves as a mouthpiece for the rescuer.

2. Place the head in the "sniffing position" and prevent air leakage (Figures 8, 9).

a. Grasp the jaw with both hands firmly and pull upward (Figure 9). This must extend the neck so the chin is "leading" and the front of the neck is stretched.

b. Close the victim's nostrils by pressing them together with the large part of your thumbs (Figure 8).

c. Close the corners of the victim's mouth by pressing the flange firmly against the victim's lips with your thumbs (Figure 8). You may prevent air leakage through the victim's nose and through the corners of the victim's mouth by any other desired position of your thumbs and fingers, as long as the victim's head is held in the "sniffing position," so the front of the neck is stretched.

3. Blow air into the lungs (Figure 9).

a. After taking a deep breath, blow into the mouthpiece of the airway. Blow forcefully into adults and gently into children. In a baby, blow only small puffs from your cheeks, not from your lungs, to prevent damage to the baby's lungs. In a premature baby, insert the #1 end of the baby airway only partially.

b. While blowing, watch the victim's chest. When the chest rises, stop blowing and quickly remove your mouth from the mouthpiece of the airway.

c. Let the victim exhale passively by the elasticity of his lungs and chest.

d. When the chest does not rise, improve the "sniffing position," prevent air leakage, and blow more forcefully. If the chest still does not rise, readjust the position of the mouth-to-mouth airway.

e. Repeat these inflations 15 to 20 times per minute.

4. Caution: With the S-shaped airway in place, the victim will gag and may vomit when recovery takes place. At the first sign of a gag reflex or revival, remove the airway.

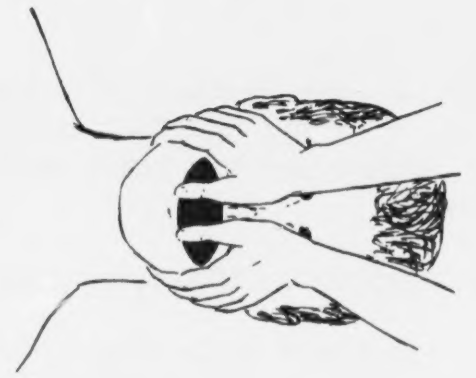


FIGURE 8. Flange over victim's lips

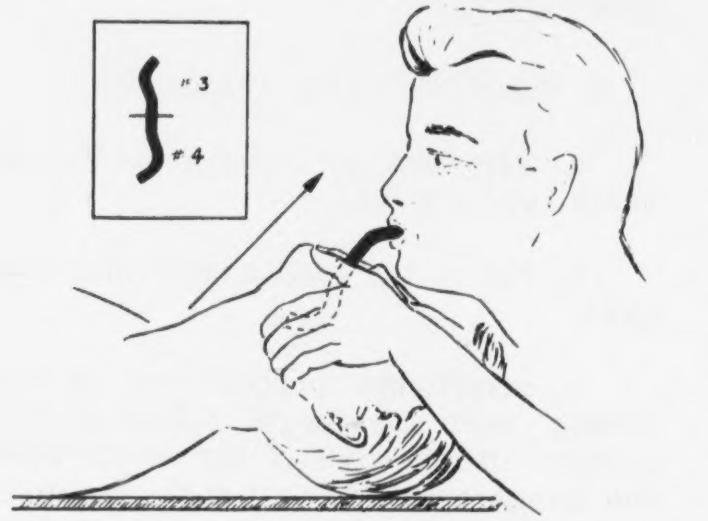


FIGURE 9. Rescuer is (a) holding victim's jaw up, (b) holding flange airtight, and (c) applying mouth-to-airway breathing.

FURTHER CONSIDERATIONS

When Air is Blown into the Stomach - After either mouth-to-airway or mouth-to-mouth breathing has been performed for a period of time, the victim's stomach may be bulging. This bulging is due to air which is blown not only into the victim's lungs but also into his stomach. Air inflation of the stomach rarely occurs when the correct technique is applied, but rather will occur more frequently (1) if the air passageway is blocked by improper support of the head and lower jaw, and (2) if the blowing is too forceful.

Air inflation of the stomach is not dangerous, but inflation of the lungs is easier when the stomach is empty. Therefore, when the rescuer sees the stomach bulging, he should interrupt blowing for a few seconds and press with his hand between the victim's navel and breastbone which causes the air to be "burped." Since this maneuver may also make the victim vomit, the rescuer must be ready to clear the throat at once, as shown in Figure 2.

APPARENT NATURAL BREATHING

1. The victim may only appear to be breathing naturally by movements of his chest and abdomen, while actually no air may be moving into his lungs due to complete blockage of the air passageway from improper positioning of the head and jaw. Therefore, it is most important to determine whether or not there is any movement of air in and out of the mouth and nose by listening closely or feeling with the fingers in front of the victim's mouth and nose.

2. The victim may breathe noisily (snoring), which indicates partial blockage of the air passageway.

Therefore, even if the unconscious victim appears to be breathing naturally, the rescuer must hold the victim's head in the "sniffing position" and hold the jaw upward at all times (Figures 3 and 4). If an artificial airway is available (for instance the mouth-to-mouth airway), it should be inserted provided that the victim can tolerate it without gagging or coughing (Figure 7). The victim's head must still be held in the "sniffing position." If the victim vomits, the rescuer must clear the throat and mouth swiftly with the fingers (Figure 2). It is extremely important that the rescuer remains at the victim's head during transportation at all times, in order to keep the victim's air passageway open by the methods described above and to start mouth-to-airway or mouth-to-mouth breathing at once when the victim ceases to breathe.

Shallow Breathing and Assisted Breathing - When the victim breathes shallowly, he may not be getting sufficient amounts of air into his lungs. His lips and tongue may appear blue or gray instead of pink. In such cases, the rescuer may deepen the victim's shallow breaths by blowing into the mouth-to-mouth airway or directly into the mouth immediately after the victim starts inspiring. This is called "assisted respiration." The rescuer uses deep inflations of short duration and removes his mouth from the airway or from the victim's mouth rapidly, so as not to interfere with the victim's natural exhalation.

NOTE: In mouth-to-mouth resuscitation, there may be some unpleasant events take place that must be overcome. Convulsions may develop, and during the seizures spasms of the jaw muscles can cause painful bites to the squadman. Vomiting may occur during recovery, and water may spurt from the mouths of drowning victims when air is blown into the lungs. Mouth to nose may be used during the convulsions; a piece of wide gauze or cloth can be placed over the victim's mouth to avoid direct contact. The use of an adjunct such as the S-shaped airway has proven effective in overcoming may objections. Fear of contacting a contagious disease has been expressed by many individuals. This is unfounded for statistics have proven that there is little or no danger of the rescuer becoming infected.

BACK-PRESSURE, ARM-LIFT METHOD

Prior to the use of mouth-to-mouth, the back-pressure, arm-lift method of artificial respiration was accepted throughout the nation as the one of choice. However, this method is not effective in the majority of cases because the head drops as the arms are raised, and this action blocks the air passage. If, however, another squadman is available to hold the victim's head up and in this way maintain an open airway, then the back-pressure arm-lift becomes effective in those cases of severe face, lip and mouth injuries that may rule out mouth-to-mouth resuscitation. See Figure 10.

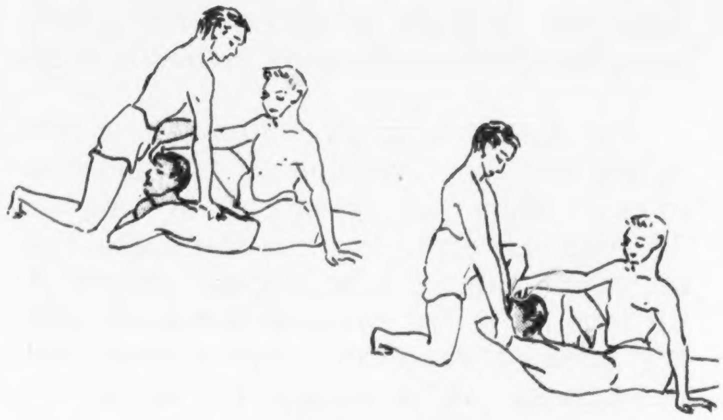


FIGURE 10. Back-pressure arm-lift method showing positioning of a two-man team.

MANUALLY OPERATED VENTILATION DEVICE

THE SELF-INFLATING BAG-MASK

A typical manually-operated ventilation device consists of a self-refilling bag, a valve to prevent rebreathing, and a full face mask. The mask, usually held with the left hand (right hand if operator is left handed), is applied to the victim's face tightly enough to prevent air leakage. The same hand is used to extend the head and neck, and support the jaw to maintain an open air passage. With the other hand, the bag is squeezed, forcing air into the victim's lungs; expiration is passive due to the elasticity of the chest muscles and diaphragm. See Figures 11 and 12.

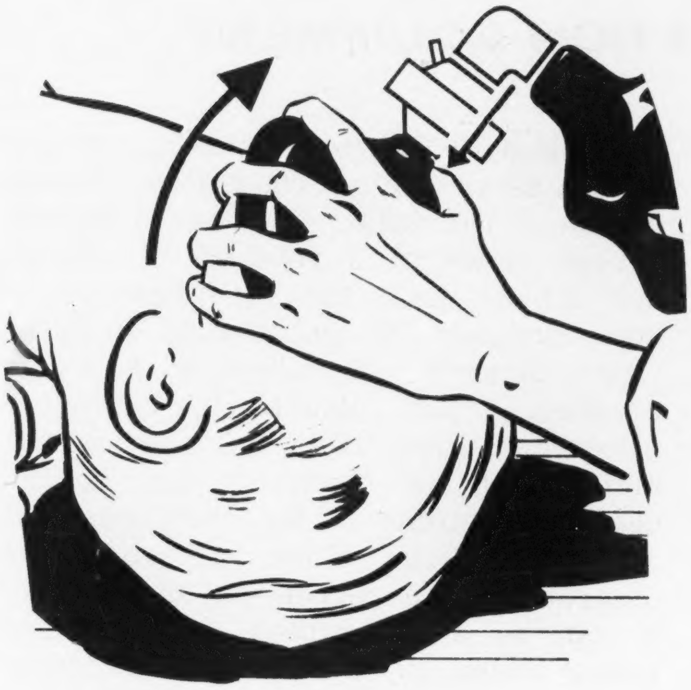


FIGURE 11. While pressing the mask tightly to the face, the jaw is kept forward and the head tilted back by keeping an upward pressure on the lower jaw as indicated.

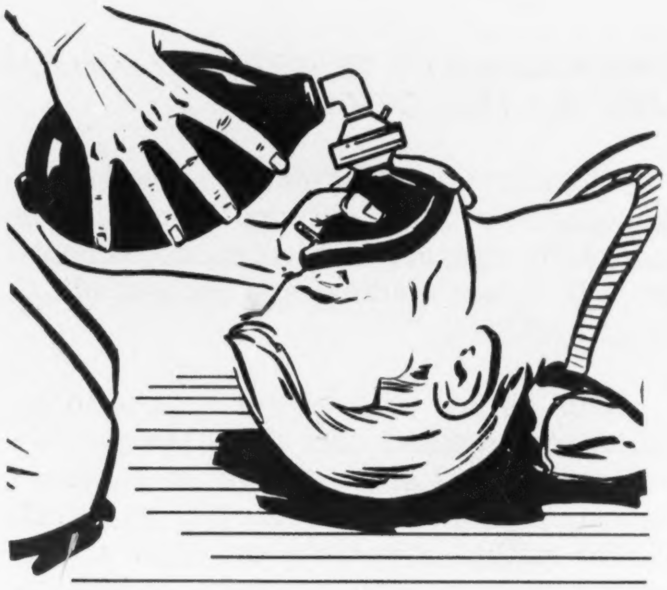


FIGURE 12. Grasp the resuscitator bag with the fingers spread wide as shown. Squeeze until the victim's chest rises, then release pressure.

The bag should be easy to grip and to compress and should allow for rapid ventilation of infants. The bag should be made of material that retains its elasticity, and will be operable over a wide range of temperatures and prolonged storage. There should be an inlet to provide supplementary oxygen to refill the bag. The valve assembly should be easy to clean and one that will not freeze when operated in low temperatures. The mask should preferably be transparent, cover the nose and mouth, and easily fit the victim's face to prevent air leakage.

(A plastic oral airway should be available for use to help maintain an open air passage.)

Used by trained persons, the bag-mask provides ventilation superior to that achieved with mouth - to - mouth breathing. However, a rescuer who has not acquired the necessary skills, and, if he must work alone, or whose hands are not large enough or strong enough to manage both the mask and airway control, will do better with mouth-to-mouth breathing.

MECHANICAL VENTILATION EQUIPMENT

THE MANUALLY TRIGGERED OXYGEN VENTILATING DEVICE

The manually triggered demand valve resuscitator is a new appliance that is simple to operate and has gained acceptance by many medical and para-medical organizations.

This device will deliver oxygen inhalation on demand and will also provide intermittent positive pressure resuscitation. It can be operated from a wall outlet within a vehicle or from a tank with a proper reducing valve as a portable unit. A maximum flow rate of 150 liters per minute can be delivered when the regulator outlet pressure is 50 pounds per square inch. This is claimed to be enough flow to ventilate the victim in spite of major leaks that may occur around the mask.

As an inhalator the demand valve may be used with a full-face mask or a tracheotomy tube. An inspiration effort of -1 (minus one) centimeter of water will provide sufficient flow to ventilate a victim at rest. With -3 (minus three) centimeters of water the valve permits a minimum flow of 150 liters per minute if the inlet pressure to the valve is 50 pounds per square inch. The valve will provide oxygen inhalation as demanded by the victim, shallow inspirations will permit a decreased flow; and deep inspiration will permit greater flows. The valve will release instantly when the victim exhales, thus permitting full respiration control by the victim according to his need.

As a resuscitator the demand valve is attached to the proper size full-face mask or tracheotomy tube. The mask is applied to the victim making as tight a seal as possible. The button, located on top of the valve, is pressed and the oxygen flows at a rate of 150 liters per minute until the set pressure of approximately 54 centimeters of water (approximately 12 ounces p. s. i.) is reached. Upon releasing the button the non-rebreathing valve unloads and the victim exhales passively due to the natural elasticity of the chest muscles and diaphragm. If the valve becomes obstructed with secretions or vomitus, it can be disassembled, cleaned, and reassembled in a matter of seconds. If the valve must be cleaned, mouth-to-mouth or mouth-to-mask resuscitation must be applied until the device is again operable, for time is of the essence in resuscitation.

OPERATING PROCEDURES -- THE NON-BREATHING VICTIM

1. Position the victim; flat on the back with the head extended to the "sniffing position"; the victim may also be resuscitated in other positions providing maximum attention is given to the opening of the air passage.

2. One rescuer will immediately start mouth-to-mouth or mouth - to - mask breathing until the second rescuer readies the equipment. Realizing that it only takes seconds to ready the device, these seconds may mean the difference between success and failure, or to put in more directly, the difference between life and death.

3. The resuscitator is put into operation by opening the cylinder valve by

attaching and turning the hand wheel in a counter-clockwise direction. The regulator gauge will then indicate the contents of the tank in pounds per square inch. A full tank will contain between 1800-2200 p.s.i. dependent upon temperature and atmospheric pressure.

4. The hose is "pre-connected" from the regulator to the valve head; remove the valve head from the case and attach to it the proper size face mask.

5. Position the mask on the victim's face, holding the mask with the thumb and forefinger, and using the other fingers to grasp the chin and lower jaw. Apply sufficient pressure on the mask to make an airtight seal to the victim's face, at the same time, extending the head and neck to the "sniffing position" to open the air passage.

6. Depress the button and hold it until you see the chest rise. As soon as the chest begins to rise, release the button and allow the victim to exhale passively. Repeat this cycle approximately 15 times per minute.

7. Continue resuscitation until the victim is revived or pronounced dead by a physician.

8. Failure of the chest to rise will indicate a blockage. If this occurs, reposition the victim's head. If the chest still does not rise, check the mouth. If foreign matter is present, remove it by scooping the mouth out with your finger. If the tongue is blocking the air passage, insert an oral airway. Fluids, such as blood, liquid vomitus, etc., must be removed by aspirating with a suction machine. (Suctioning is described later in this chapter.) The demand valve resuscitator does not have a built-in aspirator, therefore, it will be necessary to carry a portable suction device to clear fluid blockages.

THE AUTOMATIC CYCLED OXYGEN VENTILATOR (RESUSCITATOR)

The resuscitator, incorporating the ability to serve as an automatic breathing machine, an inhalator and an aspirator, combined in one compact unit, has served the emergency care service for many years. It has been stated that the resuscitator was the most frequently used piece of equipment on any emergency squad.

Since the application of closed chest heart compression has been accepted as a mandatory measure for successful resuscitation of the victim who is void of breathing and a pulse, the following statement was issued by the Ad Hoc Committee on Cardiopulmonary Resuscitation of the National Academy of Sciences, Division of Medical Sciences:

> "Conventional pressure - cycled automatic ventilators or resuscitators are not recommended for use in conjunction with closed chest heart compression. . . ."

Realizing that "the resuscitator" is still being carried and being used by many emergency squads, and realizing that "the resuscitator" may still be an effective aid to resuscitation in those cases where breathing has stopped and the pulse and heartbeat still exist, the following material is included in this text to assist and hopefully provide reasonable instruction for its use.

Although resuscitators may vary in their operation, the manufacturers are in agreement as to the techniques to be used in applying mechanical artificial respiration.

Manual artificial respiration must be applied at the scene immediately. Do not stop until a squadman checks the mechanical resuscitator to see if it is operating properly.

The operation of most machines may be checked by placing the hand over the face piece to see if the blockage signal is obtained.

After the machine has been checked and found to be operating properly, proceed to place the proper size face piece over the nose and mouth of the victim. Stop manual artificial respiration then, and put the machine into service. It is of the utmost importance to place the victim in a position that will tend to keep fluids and other materials out of the breathing passages. This position should allow the operator of the resuscitator to have full access to the victim's face. The inside of the mouth and back of the throat should also be visible so they can be examined easily. To accomplish this, place the victim in a supine position with the head held back and the chin in the "sniffing position." A pillow, folded blanket, or some other object placed under the victim's shoulder blades will help facilitate a satisfactory position for mechanical resuscitation (Figure 13).

Be sure that the victim's mouth and throat are clear. Remove all foreign matter, such as gum, chewing tobacco, loose dentures, or other materials that could block his air passage. If considerable mucus is present, aspirate it immediately to provide a clear air passage.

The efficiency of mechanical resuscitation depends on the successful maintenance at all times of the so-called "closed circuit." This means that an airtight connection must be maintained between the machine and the victim's lungs. This, in turn, means that there must be airtight connections within the machine itself, that the mask valves must be closed, and that the mask be airtight to the victim's face. If the face piece is the type that can be inflated, it should be kept at all times.

Since most commercially made resuscitators have rubber cushion face pieces, it is relatively easy to create an airtight connection, provided the position of the squadman's hands upon this mask and the victim's face is the correct one. The thumb and index finger of each hand should encase the mask on the victim's face. The thumb and index finger of each hand should encase the mask on the victim's face. This is done by placing them on their respective sides of the mask. (See Figure 14.)

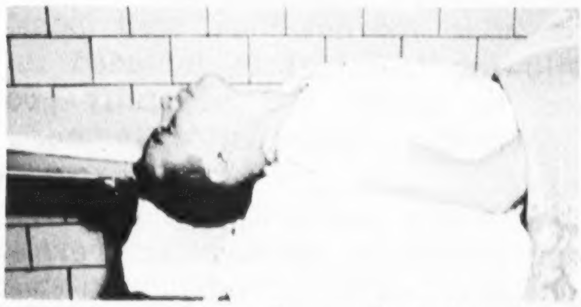

Courtesy St. Anthony Hosp.

FIGURE 13. Position of victim for mechanical resuscitation

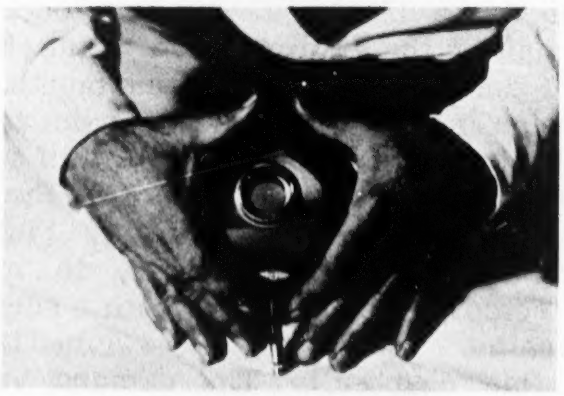
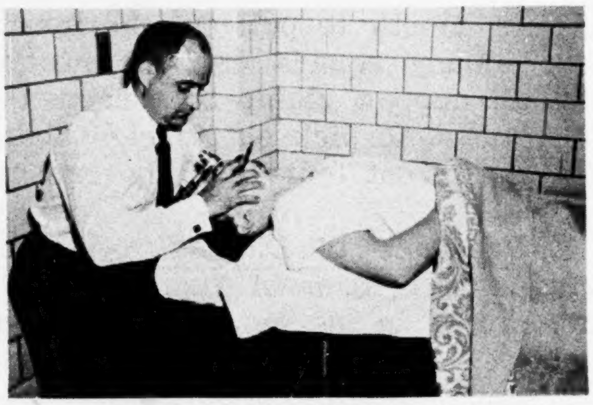


FIGURE 14. Position of operator's thumbs and index fingers on mask

The other three fingers of each hand grasp the victim's chin from beneath, thus creating a good air passage by opening the windpipe. (See Figure 15.)

If the victim has such an injury that parts of the face are missing, or the person's face is sunken from illness or age, or possibly the victim may have his false teeth out at the time of the emergency, the squadman is confronted with a problem. The face piece will not fit tightly against the face, and a closed circuit cannot be obtained. In this case the squadman will discard the resuscitator and go immediately to mouth-to-mouth resuscitation.



Courtesy St. Anthony Hosp. & Millersport F. D.

FIGURE 15. Position of operator's hands on victim during resuscitation

PROPERLY WORKING MACHINES

If the machine is breathing adequately for the victim, a series of two separate clicks will be audible to the operator. There will be a click from the machine when the oxygen goes in, and another click when the carbon dioxide is pulled out. This positive and negative pressure going in and out of the lungs is called an interval. A regular rhythm of intervals results after the machine begins to breathe for the victim. This is the same kind of rhythm maintained during manual artificial respiration. This rhythm of intervals is the clue which lets the operator know that the machine is working properly, accomplishing the life-saving purpose for which it was manufactured.

BLOCKAGE

Oftentimes when mechanical respiration is first started, there may occur a fast tripping or clicking sound instead of the regular rhythm. This is caused by blockage. As soon as the blockage signal is heard, remove the face mask and look into the mouth for the possible cause of the blockage. Such blockage or obstruction of the positive and negative pressure may be due to one or more of four things.

1. Presence of Foreign Bodies (Solids) -- This includes broken dental plates, gum, chewing tobacco, broken teeth, seaweed, or any other foreign object in the breathing passages.

It is imperative that such foreign bodies be removed immediately. Since a non-breathing victim is unable to bite, the easiest procedure is to introduce the thumb and index fingers into the victim's mouth to pull out the foreign body. Many squads carry some type of small narrow clamp or forceps that can be used to pick out foreign bodies from the throat (curved Kelly forceps).

2. Presence of Liquids --- This includes any form of liquid material that may be in the mouth or breathing passages. It may be blood, water, clear liquid vomitus, or any other liquid material. Procedures for suctioning are detailed later in this chapter.

3. Tongue -- When a person is unconscious or has stopped breathing, he becomes so relaxed that the tongue drops further back in the throat than usual. A common example of this is when a sleeping person snores. The tongue has dropped back in the throat causing a poor air passage which is denoted by a loud sound. In asphyxia victims the tongue actually falls back over the air passage and prevents oxygen from entering the lungs.

To alleviate this blockage, the squadmen must be able to keep the tongue elevated in the mouth, so as not to block the windpipe. This can be accomplished by inserting an airway.

4. Spasm of the Throat - The vocal cords, which are encased in the "Adam's Apple," are very delicate muscles. Consequently, all respiration problem victims are prone to spasms of the vocal cords. These spasms are known as laryngeal spasms.

Even hospital personnel are at a loss when a patient goes into a laryngeal spasm, and they are forced to take drastic measures by inserting a tube below the vocal cords. This, of course, cannot be carried out by emergency squadmen, and the only last measure that can be used is to give life-saving oxygen to those victims by applying the face mask and leaving the machine on resuscitation. If this is done, a continuous blockage signal will be heard. While holding the face piece in place and receiving the blockage signal, the squadman should pull the head into a backward position and turn it from side to side very slowly. As soon as the machine is able to get past the spasm, it will indicate so by returning to the normal resuscitation sounds. The head position mentioned should be maintained until the victim begins to breathe on his own.

Continual attempts should be made to resuscitate the victim until the victim is pronouned dead by a physician.

SUMMARY

Blockage Cause	Squad Care
Foreign bodies	Pull them out with finger or clamp.
Liquids	Suction with aspirator.
Tongue	Insert an airway.
Spasm of the throat	Turn victim's head slowly from side to side.

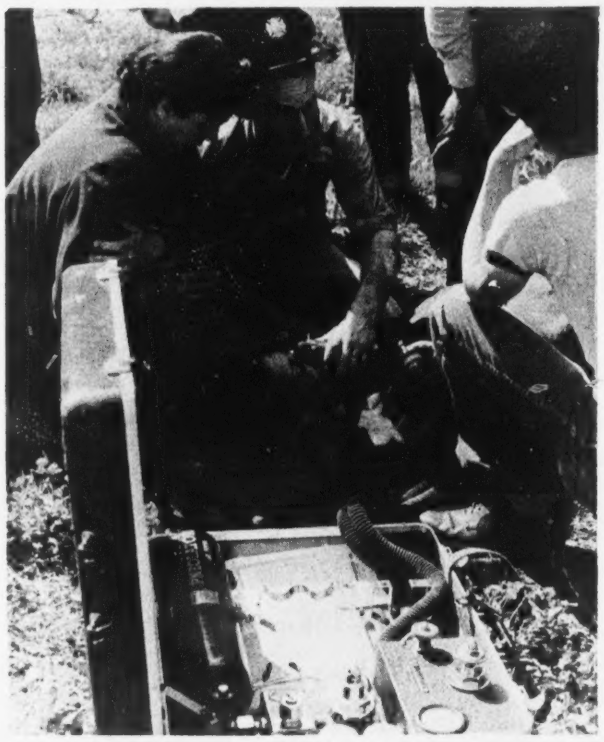
Continuously observe the victim; if the pulse should disappear and the pupils of the eyes become dilated, you must start closed chest heart compression immediately.

CAUTION: Do not be misled by the cycling action of the resuscitator by thinking that you are feeling a pulse.

USING THE INHALATOR

After the victim starts to breathe on his own, the machine should be turned to inhalation. (See Figure 16.)

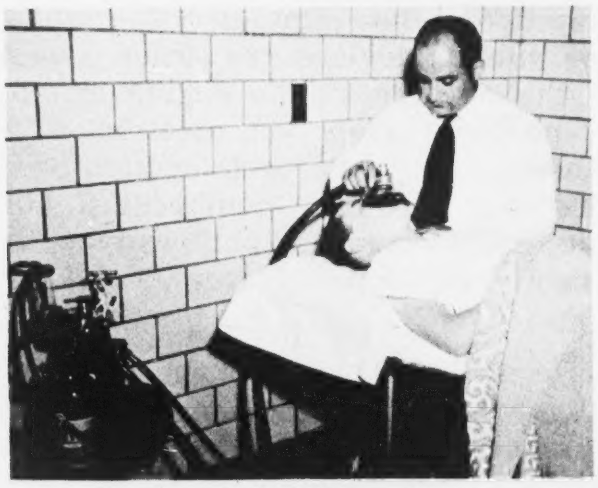
The squadman must watch the victim very closely at this time. If there is an inhalator bag on the apparatus, watch it closely. The rise and fall of the bag will denote the size and rate of the victim's respirations. If there is no bag on the machine, you must watch the victim's respirations by the rise and fall of his chest and abdomen. (See Figure 17.)



Courtesy Northern Hills F. D.

FIGURE 16. Fire department emergency squadmen administering oxygen by means of an inhalator to young victim of a near drowning. The mask is held snug to the face and the apparatus is set to administer a sufficient amount of oxygen.

As the victim's pulse, respirations, color, and general condition improve, wean him from the oxygen. This can be done by turning the flow of oxygen down slowly. Let the victim breathe for two or three minutes, then turn the flow down further. If the victim's pulse does not increase, his color stays the same and his respirations do not increase, the squadman may continue the same routine until the flow of oxygen is nearly off. Take the mask away from the face slightly. This will allow the outside air to mix with the resuscitation oxygen, so that the victim becomes adjusted to breathing outside air.



Courtesy St. Anthony Hosp. & Millersport F. D.

FIGURE 17. This picture illustrates the use of an inhalator after resuscitation. The mask is held lightly but not too tightly on the face. Notice that the squadman is watching the victim closely and has the machine in a position to reach and to watch.

After he is breathing normally, the victim should be kept prone and remain under observation until he is transferred to the care of a physician or of hospital personnel. (See Figure 18.)

Courtesy St. Anthony Hosp. & Millersport F.D.

FIGURE 18. After resuscitation, inhalation, and aspiration, the victim is put in a flat position and watched.

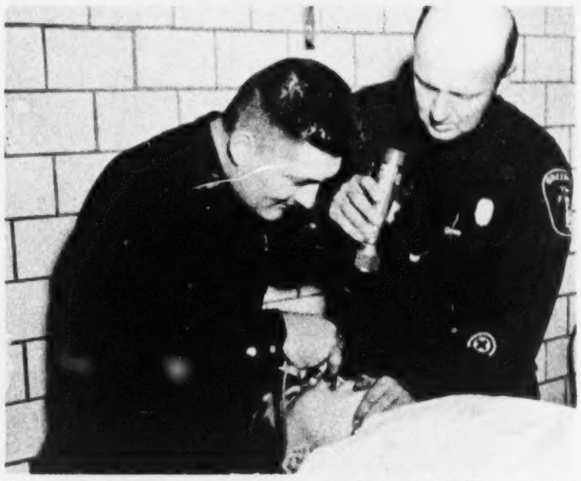
SUCTIONING OF THE MOUTH AND UPPER AIR PASSAGE

Suction devices or aspirators are used to suction out liquids and other fluid material from the victim's mouth and upper air passage.

Suction devices are of two types, those that are built-in to the vehicle, and those that are portable for use away from the vehicle. The built-in type suction devices are either powered by the vacuum of the engine manifold or powered from an electric driven vacuum pump. Portable suction equipment may be a hand-compressed, bulb-type, a foot-operated bellows type, or a recently developed battery - powered type.

Regardless of the type used, the delivery tube should be long enough to reach the victim as he may be positioned in the vehicle or at the scene. The tubing must be firm to prevent kinking and possible collapse under the vacuum. Collection bottles, preferably made of clear plastic so that the aspirated material may be noted, should be used. Rigid suction tips made of plastic or metal are recommended over the rubber catheters. However, it is suggested that the French-type suction catheters of various sizes be carried.

When suctioning mucus out of a victim's mouth, the suction catheter or tip must be moved about so as to include all areas of the mouth, and so that it will not attach itself by means of suction to the inside of the victim's mouth, thus preventing it from fulfilling its purpose. (See Figure 19.)



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

FIGURE 19. When suctioning a victim, you should have proper lighting (as shown). The victim's mouth should be open wide. The suction catheter should be held securely between the index and second fingers. The catheter should be moved around so it will get all materials and not attach itself against the inside of the mouth.

To gauge the maximum depth of catheter insertion, measure the catheter from the lips to the lobe of the ear.

A good practice exercise is to use a glass of water and have each squadman practice suctioning water by holding the catheter between the thumb and index finger. The catheter should be held in the same way when suctioning mucus from a victim.

A soft rubber ear syringe may be used instead of a catheter. By squeezing out all the air from the syringe, inserting the tip in the victim's mouth and releasing the bulb, suction is produced and the syringe will act as an improvised aspirator.

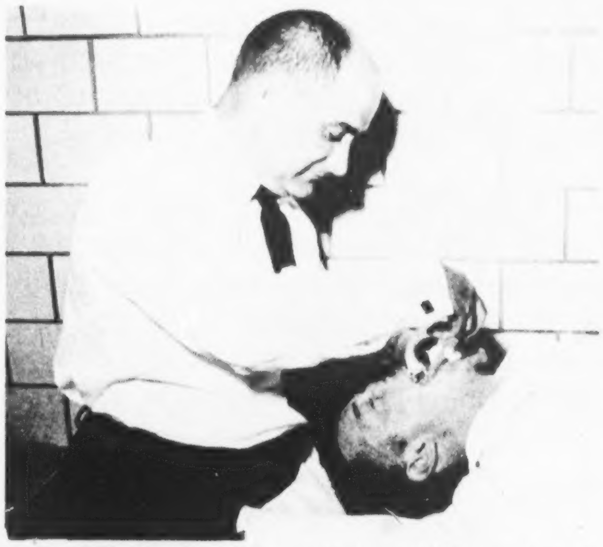
ORAL AIRWAYS

Oral airways are curved tubes that are inserted in the victim's mouth to hold the base of the tongue forward, and to prevent obstruction that may be caused by the lips and teeth. Even with the oral airway in place, the victim's head must be maintained in the so-called "sniffing position." (See Figure 20.)

The most commonly used oral airways are either the regular ones for use under a face mask, or the S-shaped tubes for mouth-to-mouth resuscitation.

Airways should be inserted only if an adequate air passage cannot be maintained. Unnecessary insertion of an oral airway may cause a laryngospasm (spasm of the voice box) and a delay in ventilation.

To insert an airway properly, the victim's mouth is opened, and the tongue is grasped firmly top and bottom and gently pulled out beyond the lower lip. With the mouth open and the tongue out, the proper size airway is inserted into the victim's mouth. A tongue clamp is a good instrument to use in extracting the tongue; furthermore, the clamp can be carried right in the resuscitator box. In the event a tongue clamp is unavailable, the squadman can pull the tongue out with his fingers.



Courtesy St. Anthony Hosp. & Millersport F. D.

FIGURE 20. Proper insertion of airway

The best way to ascertain the correct size of an airway is to hold the airway to the side of the face. The lower tip should touch the angle of the chin (just below the ear lobe) and the other end should extend beyond the lips.

The best way to insert an airway is to put its tip against the roof of the mouth, just behind the upper teeth, and slide it down a distance determined by the size of the victim's throat. All airways should be inserted according to the contour of the victim's air passage. Always remember to keep the victim's tongue out of the way while inserting the airway. If the type of airway available is one without lips, tie a six- to eight-inch string or gauze to the end of it.

As soon as the airway is in place, resuscitation should be resumed.

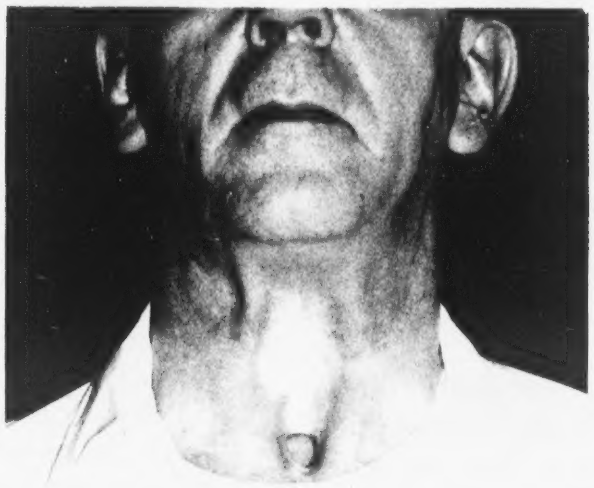
EMERGENCY CARE OF THE LARYNGECTOMY VICTIM

The victim who has had his larynx (voice box, also "Adam's Apple") removed requires special emergency care. These are people who because of some disease, accident, or other medical condition, have had surgery performed on their voice box with the end result of its being partially or totally removed.

From the time of surgery, these people will never again breathe through their mouths. At the time of the removal of the "Adam's Apple" , an opening is made at the lower part of the neck, just above the breast bone. It is through this opening that the "laryngect" must breath for the remainder of his life. They are commonly referred to as "the neck breathers".

As shown in Figure 21, a patient's neck is exposed and the "stoma" (permanent opening in the neck to the windpipe) is visible.

If his shirt were closed, or he had on a T-shirt or a shirt and tie, the stoma would not be easily seen.



Courtesy Clinton Twp. F. D. & Franklin Co. Cancer Soc.

FIGURE 21. After laryngectomy, man receives air into his lungs through neck opening (stoma).

Women with stomas wear high necklaces. These partially cover the opening and unless closely investigated, it might be overlooked.

A side view of this man (Figure 22) shows that he does not have an "Adam's Apple". This is one good way to tell a "neck breather". You could obstruct this man's mouth and nose for hours and it would not disturb him, as he does not breathe through them.

RESUSCITATING THE VICTIM

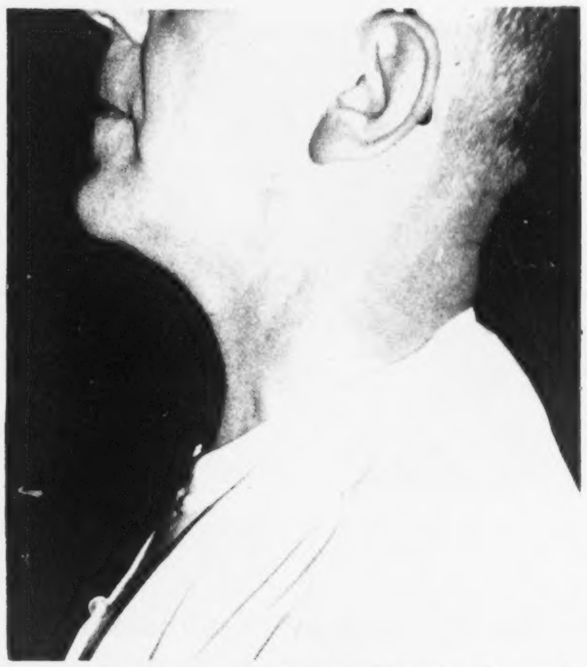
If this type of victim should stop breathing, the squadman would use the manual or mechanical artificial respiration that is used routinely, but it must be applied over the stoma.

As shown in Figure 23, the squadman must give mouth-to-stoma resuscitation with the victim on his back and the chin up out of the way of the stoma. Placing his mouth over the stoma, he would give mouth-to-stoma resuscitation following the procedure he has learned for the mouth-to-mouth method.

There is no problem of air going into the stomach because the squadman breathes directly into the windpipe. The tongue cannot obstruct the airflow, as the stoma is below it.

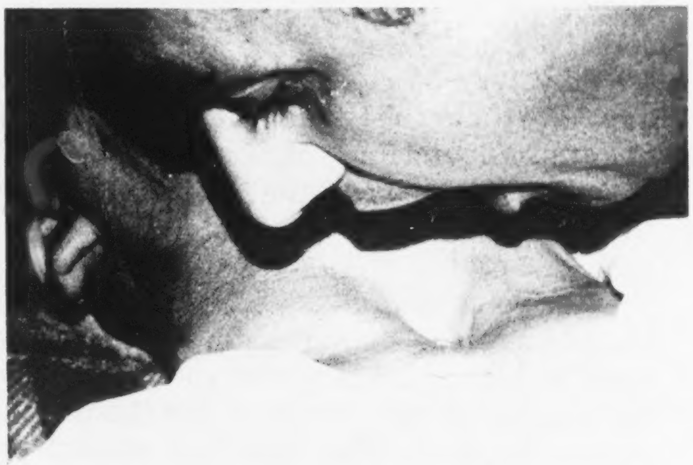
If the mechanical resuscitator is readily available, the use of the BABY mask over the stoma followed by mouth-to-mask resuscitation will aerate the victim adequately. The squadman in Figure 24 is carrying out this procedure until the resuscitator can be readied.

If the mask will not fit airtight, a moistened towel can be placed around the mask to seal off any openings. All face pieces of your resuscitation equipment should be inflated at all times.



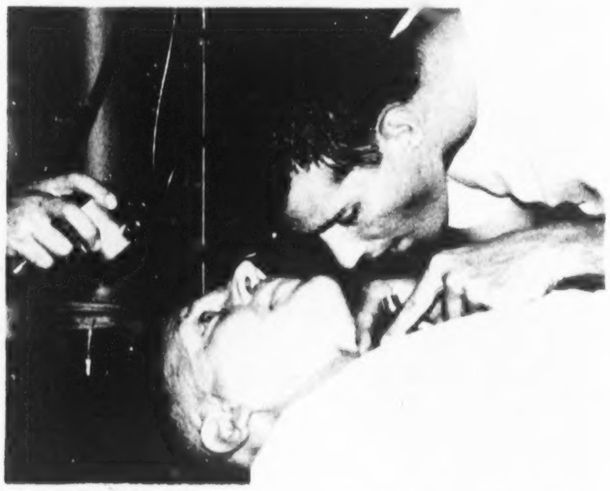
Courtesy Clinton Twp. F. D. & Franklin Co. Cancer Soc.

FIGURE 22. The absence of an "Adam's Apple" indicates that this man may be a neck breather.



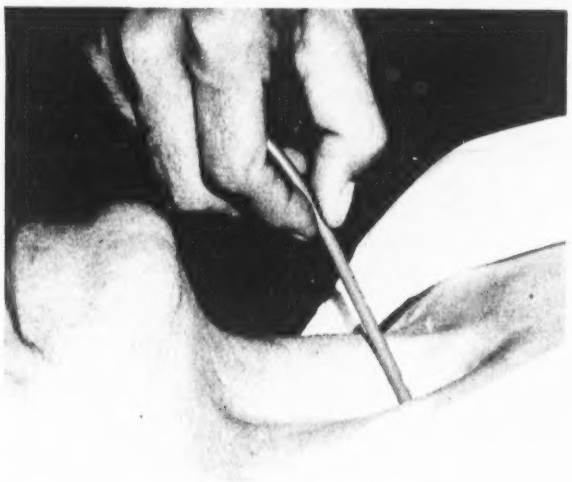
Courtesy Clinton Twp. F. D. & Franklin Co. Cancer Soc.

FIGURE 23. Mouth-to-stoma resuscitation is given.



Courtesy Clinton Twp. F. D. & Franklin Co. Cancer Soc.

FIGURE 24. A baby-size mask must be used over the neck opening for mechanical resuscitation.



Courtesy Clinton Twp. F. D. & Franklin Co. Cancer Soc.

FIGURE 25. An aspirator tube, inserted through the stoma, will remove mucus.

When the resuscitator is put into service, it should be held over the stoma as it is over the face, with the index fingers and thumbs. A folded blanket can be used under the shoulder blades. The blanket or other material helps to keep the windpipe straight and the head back.

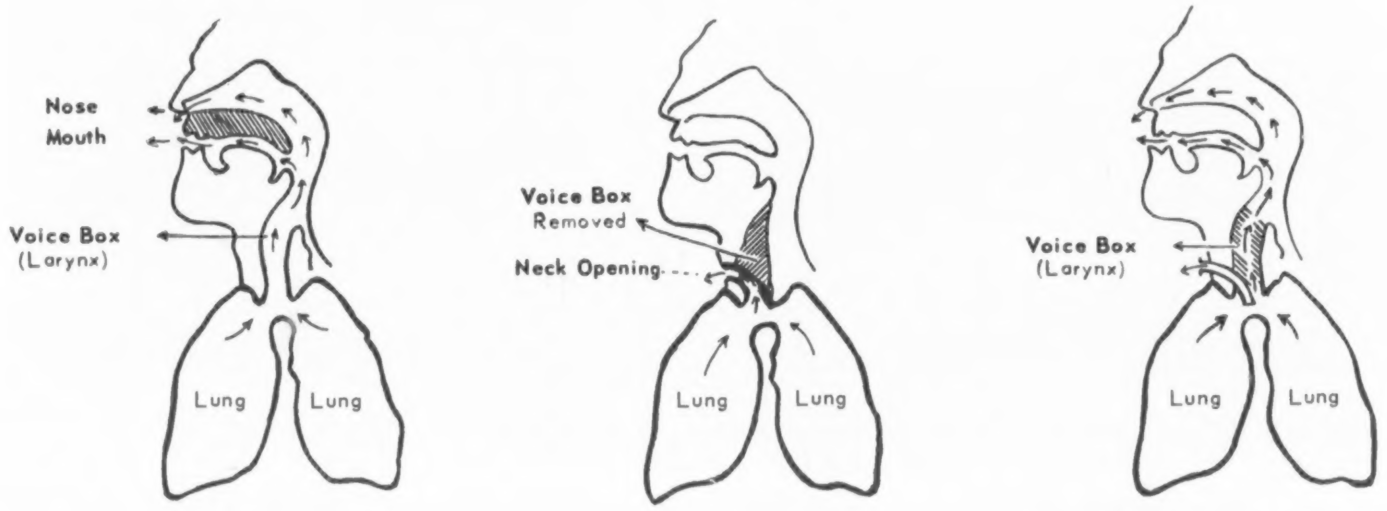
This type of victim is much easier to aspirate (suction) than the average resuscitation victim. If the resuscitator gives the blockage signal, mucus will be the usual cause.

The squadman must be sure to rotate the catheter as he suctions. The squadman in Figure 25 is doing so by rotating the aspirator tube between his thumb and index finger. The catheter should be pinched off as it is inserted into the stoma preventing damage of it, and should not be inserted more than four inches.

There are clubs throughout the nation called the "Lost Cord Clubs". These clubs are sponsored by the American Cancer Society. They are very interested in each squadman being keenly aware of their problem. When patients are released from the hospital with stomas, they are told to make themselves known to their local squad.

When a laryngectomy victim is released from the hospital, he may be cured and live a normal life. The victim who posed for these pictures has had a stoma for many years.

There is always the additional problem of visitors to your area who might be "neck breathers". The theme for the squadmen is becoming "CHECK THE NECK FOR THE LARYNGECT".



A. NORMAL

B. TOTAL NECK BREATHER

C. PARTIAL NECK BREATHER

FIGURE 26. In summary, Figure 26A shows the breathing passages of the normal individual, Figure 26B shows the breathing passage of the total laryngect, and Figure 26C shows a partial neck-breather.

Occasionally an individual may be found that is a partial neck-breather. It must be remembered that in the resuscitation of this type of a victim it may be necessary to seal off the nose and mouth if resuscitation is being administered through the stoma. A metal or plastic tube may or may not be present in the neck opening. If present do not remove it.

EXTRA EQUIPMENT

There are six extra items of equipment that should be carried with each resuscitator:

1. Flashlight - A light is needed to examine the victim's throat when blockage is encountered.

2. Suction Catheters - Each resuscitator should carry a variety of whistle - tip suction catheters. The recommended sizes are: 12, 14, 16, 18 and 20 French. With these sizes the squadman should be able to handle all problems of suctioning.

3. Airways - Each resuscitator should be provided with seven airways, as follows: Large, medium, and small adult; large medium, and small child; and the newborn size. Measuring from the edge of a victim's mouth to the end of his jawbone (under the ear) will indicate the needed size. Plastic or rubber airways are preferred. (See Figure 27.)

4. Cloth hand towel - A small tea towel or hand towel should be available (not a turkish towel.) The towel can be used as a seal around the face mask of the resuscitator, for cases when the mask will not fit tight around the face.

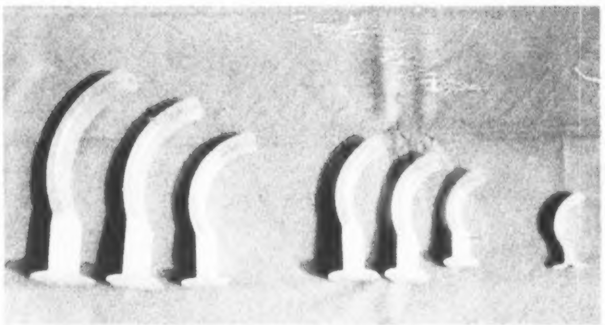


FIGURE 27. Airways: three adult sizes, three child sizes, and a newborn size.

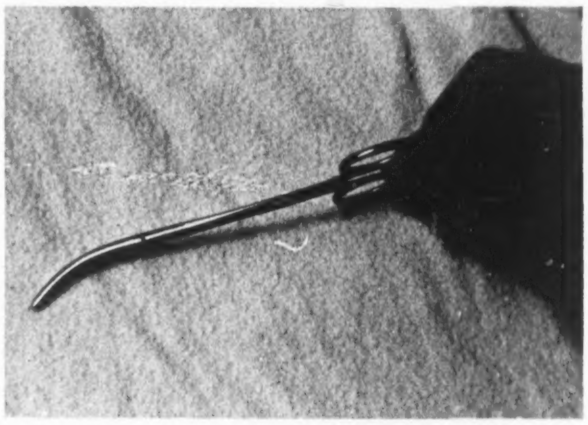


FIGURE 28. Each resuscitator should have a medium curved Kelly Hemostat or clamp. This instrument is curved to match the contour of the throat. It will easily grasp a foreign object so that it can be pulled out. Do not probe, use the clamp to remove material that can be seen but cannot be grasped with the fingers.

Moisten the towel and fold it; then fit it between the mask and the rescuer's hands.

5. Curved Kelly Hemostat - When the squadman cannot remove a foreign body in a victim's throat with his fingers, an instrument should be available for reaching into the throat to grasp the object. The curved Kelly Hemostat (sometimes called Kelly clamp) is the proper instrument. (See Figure 28.)

6. Aspirator Bottle - One extra aspirator bottle should be carried on the squad vehicle at all times, in case the bottle that is in use should crack or break.

CHAPTER XI

"CLOSED-CHEST HEART COMPRESSION AND RESUSCITATION"

INTRODUCTION

For years the physicians of our nation were coping with heart stoppage by opening the chest wall and actually massaging the heart by hand. This was done in many emergency situations, even outside the hospitals.

Then a group of researchers found that applying pressure with the hands on the outside of the chest could create the same results. This led to a whole new technique for resuscitative procedures. It was a technique that did not necessarily need a physician on the spot to carry it out. A well trained emergency squad can carry out this new procedure until the patient can be brought to definitive care in a well equipped hospital emergency room.

Some persons are concerned about the possibility of causing injuries by this technique. Close investigation has shown that no threatening or alarming damage resulted when emergency personnel who applied this technique had received formal classroom instructions, including correct demonstrations and practice.

An emergency squadman is usually the first trained person to reach the heart-stoppage victim. It is imperative that each and every squadman be completely trained in this technique.

The following text and series of pictures with captions deal with this life-saving procedure. However, studying the chapter is not sufficient. Each step must be practiced and carried out many times, so that all members of the squad are proficient in all maneuvers.

SIGNS/SYMPTOMS

Upon arrival at an emergency scene, the squadman must be able to establish whether the victim is in need of closed-chest heart compression. The need can be established by the three following findings:

1. The victim is not breathing.

2. The victim does not have a carotid, or neck pulse.

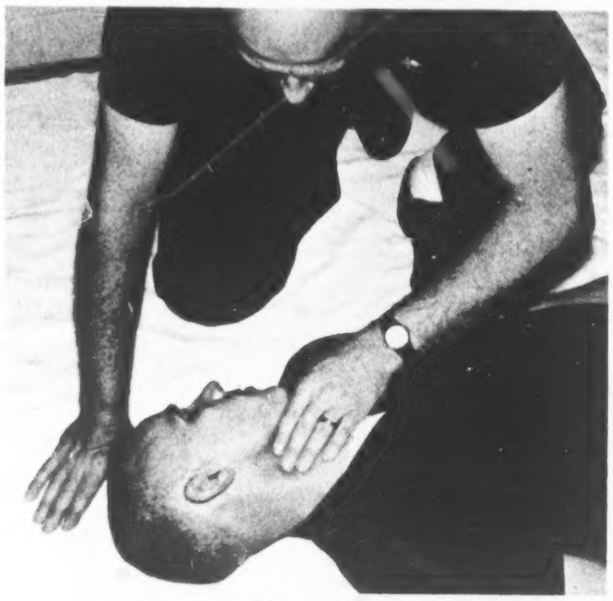
3. The pupils of the victim's eyes do not react to light.

EXAMINATION

To determine whether the victim is breathing, place one hand over his abdomen in the area of the diaphragm (just below the chest). If there is no motion, no air is being exchanged.

To establish whether a neck pulse is present, place the four fingers of one hand between the large muscle at the side of the neck and the windpipe. (See Figure 1.) If the heart is not beating, there will not be a pulse.

The pupils of the eyes usually constrict (get smaller) if a light is directed on them. This is normal. If the heart is not beating, the pupils will not react to light; they will be dilated (enlarged) and stay dilated.

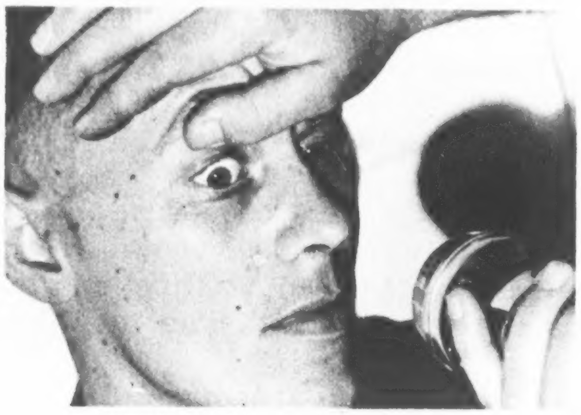


Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 1. Examining for a neck pulse

To examine the pupil, raise the eyelid quickly and direct the light of a flashlight, for a few seconds, at the pupil. If the pupil does not react, closed-chest heart compression is indicated. (See Figure 2.)

With these three symptoms present, the victim must be given closed-chest heart compression immediately.



Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 2. Examining for pupil action

PROCEDURE

For this technique to be successful, the victim must be on a firm or hard surface. If he is left on a soft surface, the rescuer will be pushing the victim into this soft surface and not compressing the heart. Lay the victim on a floor or any other hard surface. While he is in transport, place him on a backboard especially if there is a mattress on the squad stretcher. It may even be necessary to place the victim on a board and then place the board on the floor of the squad vehicle, to be able to give successful closed-chest heart compression.

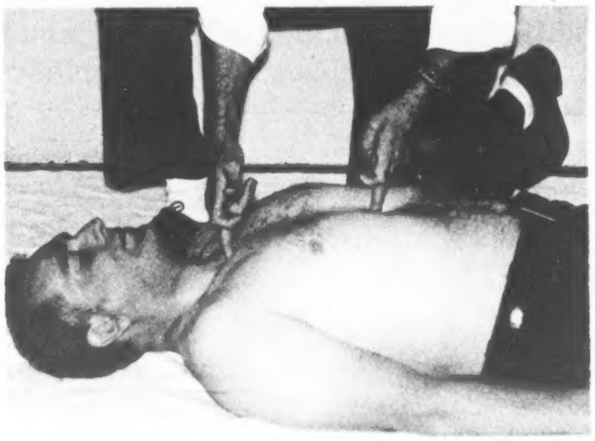
Mouth-to-mouth resuscitation and closed-chest heart compression must be given together. As soon as it is found that closed-chest heart compression must be given, four or five breaths of mouth-to-mouth resuscitation should be administered.

If two rescuers are present, one can give the mouth-to-mouth while the second measures the chest. If only one is present, the initial mouth-to-mouth breathing must be performed first. Then the squadman proceeds to measure the victim's chest region.

LOCATING THE HEART

The heart lies directly under the sternum or "chest bone." Pressure on this bone will compress the heart and force the blood out of it. Relieving the pressure will allow the heart to refill.

To locate the region where pressure is to be applied, place a finger of one hand, (preferably the index finger), at the top of the chest bone and a finger (index) of the other hand at the bottom. (See Figure 3.) The lower half of the chest bone is the exact area wanted.

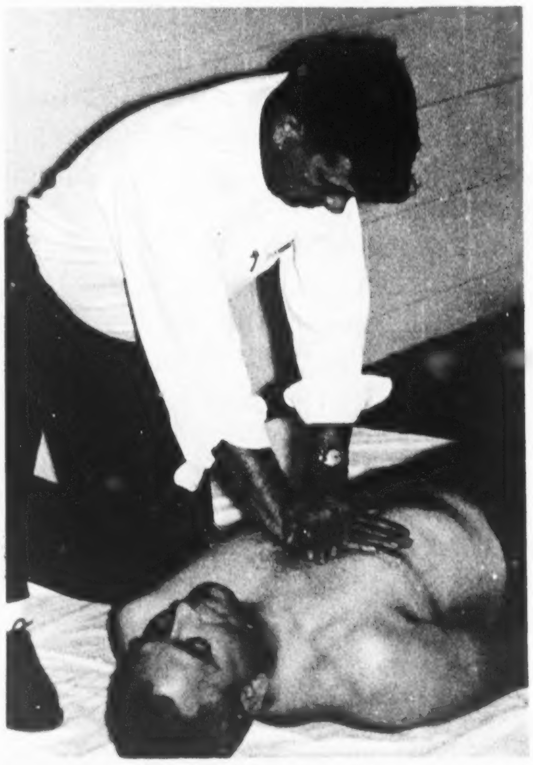


Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 3. Measuring the sternum, or chest bone

PLACING THE HANDS

Kneel beside the victim. Place the butt or heel of one hand on the lower half of his chest bone. (See Figure 4.) The butt of your hand should lie along his chest bone, with fingers extending toward his ribs.



Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 4. Placing the hands

Place the second hand over the first. The direction of the second hand is whichever is comfortable to the rescuer.

APPLYING THE PRESSURE

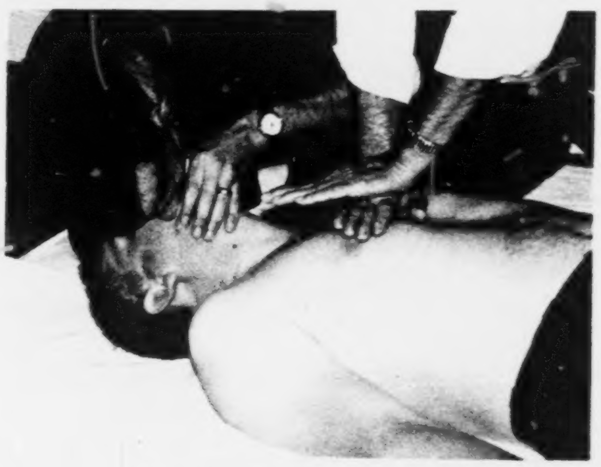
With hands on the victim's chest bone, straighten your arms until the elbows hurt. Bend forward until your shoulders are directly over your hands. Now begin to apply pressure: Push directly down until the chest bone moves 1-1/2 to 2 inches. (See Figure 4.)

Hold your fingers up off the victim's chest. This will help to keep your hands in the proper place.

The rate is 60 to 80 compressions per minute. Practice this procedure alone, and also with another rescuer, until you are sure of maintaining your rate at 60 to 80 times per minute.

METHOD FOR TWO RESCUERS

There is a definite ratio that must be maintained between heart compressions and lung inflations. For two squadmen working together, it is five closed-chest heart compressions and one mouth-to-mouth inflation. As one rescuer's hands are coming up at the end of the fifth compression, the second rescuer should be inflating the victim's lungs. The chest will rise as the hands come up. Close cooperation will maintain a rhythm and will also save time. (See Figure 5.) If the two rescuers tire, they can change positions.

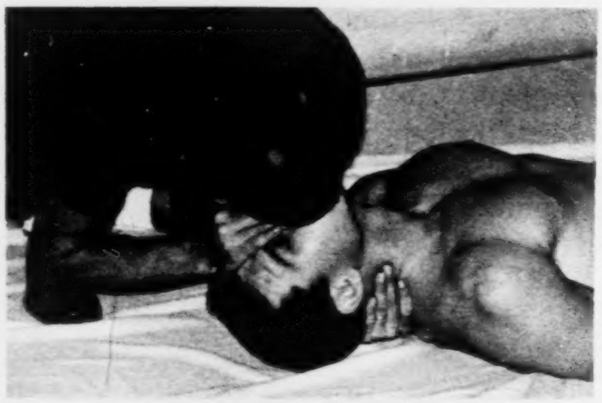


Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 5. Two rescuers working together. The rhythm is five closed-chest heart compressions and one mouth-to-mouth resuscitation.

METHOD FOR ONE RESCUER

One squadman working alone should maintain a ratio of 15 chest compressions followed by two mouth-to-mouth resuscitation breaths. When working alone, the squadman cannot take time to place his thumb in the victim's mouth, to extend the chin and head. Airway should be maintained as shown in Figure 6.



Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 6. One rescuer working alone. With one hand under the victim's neck, he supports the head in proper position for mouth-to-mouth breathing.

CHILD VICTIMS

This technique is the same for children, except that the use of one hand on a child's breastbone, or two fingers for an infant, is adequate. The compression rate for children should be 80 to 100 times per minute.

EFFECTS OF CLOSED CHEST HEART COMPRESSION

The proper application of this procedure can provide adequate circulation that will oxygenate the all important cells of the brain.

The effectiveness of heart compression and artificial respiration can be determined by observing the victim for certain signs. When the dilated pupils begin to constrict, and a pulse can be felt at the carotid artery, we can be assured that applied procedures are providing circulation. With the return of respiration and attempts of movement by the victim ("the return of life") the resuscitation procedures may stop at any step.

USE OF MECHANICAL EQUIPMENT

Regardless of the type of mechanical device used, it must be capable of providing adequate ventilation after every 5 heart compressions. This ventilation must be interposed with no reduction in the rate of chest compressions. The following is a description of the most popular types of mechanical equipment, indicating their particular characteristics.

Manually operated self-inflating bag-mask units are recommended, since their use by trained personnel permits full evaluation and correction of inflation volumes, airway obstructions, mask leaks, and proper timing of inflations without interference with the chest compressions. Bag-mask units should be designed to have an external oxygen connection to provide inflation of the bag with as high a concentration of oxygen as possible.

The conventional automatic pressure-cycled ventilators (resuscitators) are not recommended for use in conjunction with closed chest heart compression

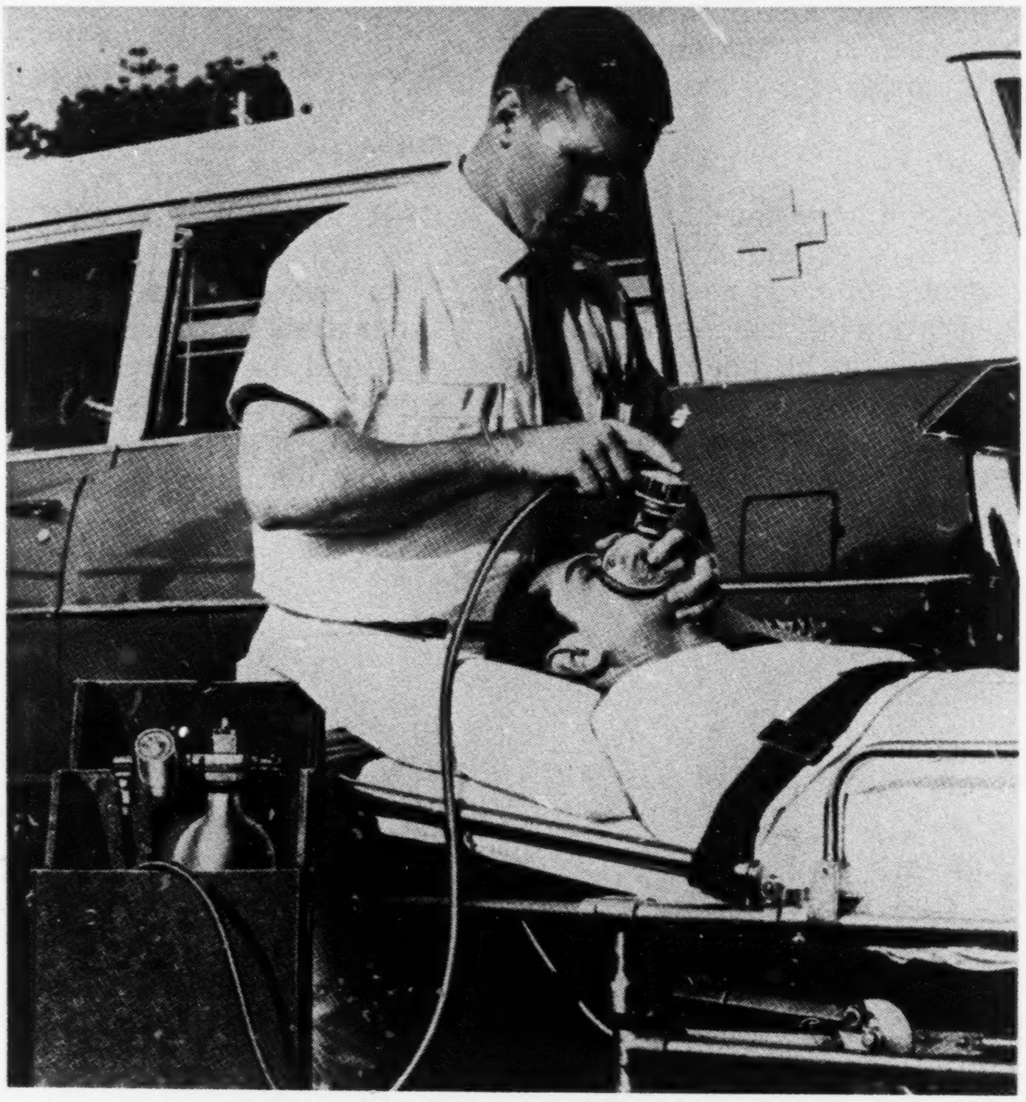


FIGURE 7. The demand valve resuscitator. This is an oxygen powered manually triggered ventilation device.

because effective heart compression triggers the cycling mechanism prematurely producing shallow and insufficient ventilation. The flow rates of this equipment are usually inadequate.

Oxygen-powered, manually triggered ventilation devices (Figure 7) are acceptable if they can provide instantaneous flow rates of 1 liter per second, or more, for adults. A safety-valve release pressure of about 54 centimeters of water (approximately 12 ounces p.s.i.) should be provided. Ideally, they should permit the use of 100 percent oxygen and hand support of the airway and mask. For use on infants and small children, specialized mechanical breathing devices producing lower flow rates are required.

External heart compression machines (Figures 8A & 8B) are adjuncts which may be used when prolonged resuscitation or transportation of the victim is required. They should be designed to approximate performance of the manual method. Their design should provide the proper head-tilt and quick application of the machine and minimize the danger of movement of the plunger in relation to the victim during use and transportation. If automatic ventilation is also provided, it should be capable of inflating the victim's lungs after every fifth compression without a pause of the plunger. When inflation is by face mask, oxygen may be forced into and cause the abdomen to distend. If this occurs, it will be necessary to remove the mask and decompress the abdominal area.

External heart compression must always be started with the manual method first. When mechanical devices are used, one rescuer must always remain at the victim's head to monitor the plunger action and ventilation, to check the pulse and pupils, and to support head-tilt and mask-fit.

CARTILAGE SEPARATION

In older persons there may be a separation of the cartilage between the ribs and the chest bone due to the pressure of closed-chest heart compression. This is not unusual and is not considered a complication.

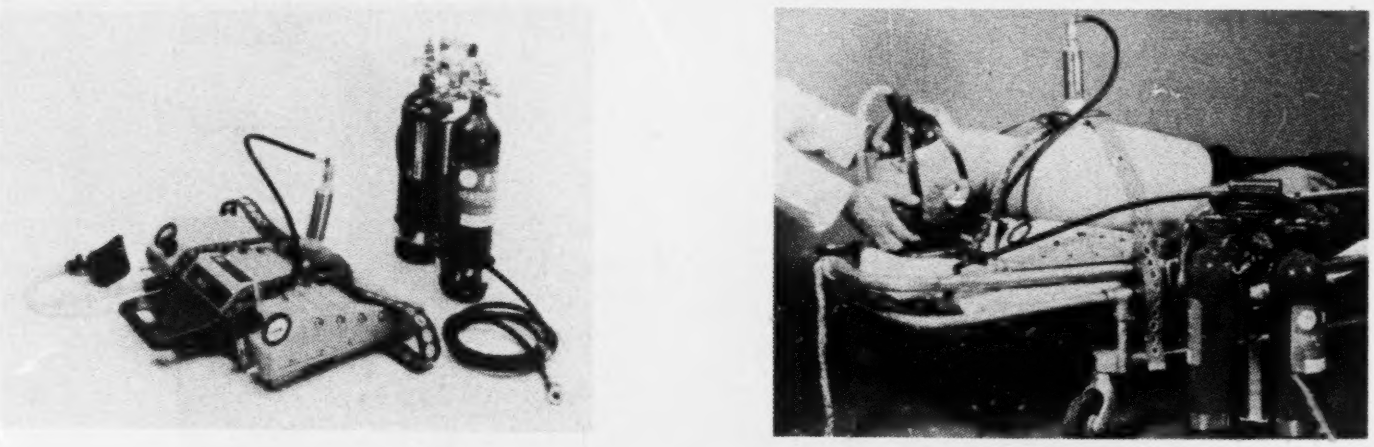


Figure 8A

Figure 8B

FIGURE 8. An external heart compression machine. Figure 8A shows the components of the machine; and Figure 8B shows the machine positioned on a victim.

COMPLICATIONS

The squadman must always be aware of possible complications. The serious consequences that would result if heart compression was not applied certainly justifies the risk of occasional complications. However, complications can be minimized with proper applications of the method.

Fractured ribs are not unusual and are usually due to applying pressure over the ribs rather than to the lower half of the sternum only. Even if a few fractures do occur, this is not a severe complication if a life is saved. There have been reported cases of lung punctures and one of a fractured sternum. All were resuscitated successfully and easily treated. More severe consequences could result from a crushed or lacerated liver due to gross misplacement of the hands.

WHEN TO STOP HEART COMPRESSION

The question will arise as to how long heart resuscitation should be continued before giving up hope. The best answer should be the victim's condition. Usually the return of heart beat occurs in 5 to 20 minutes. It has, however, been continued for 75 minutes with successful resuscitation. The squadmen will continue to exert every resuscitative effort until the victim is revived or until directed otherwise by a physician.

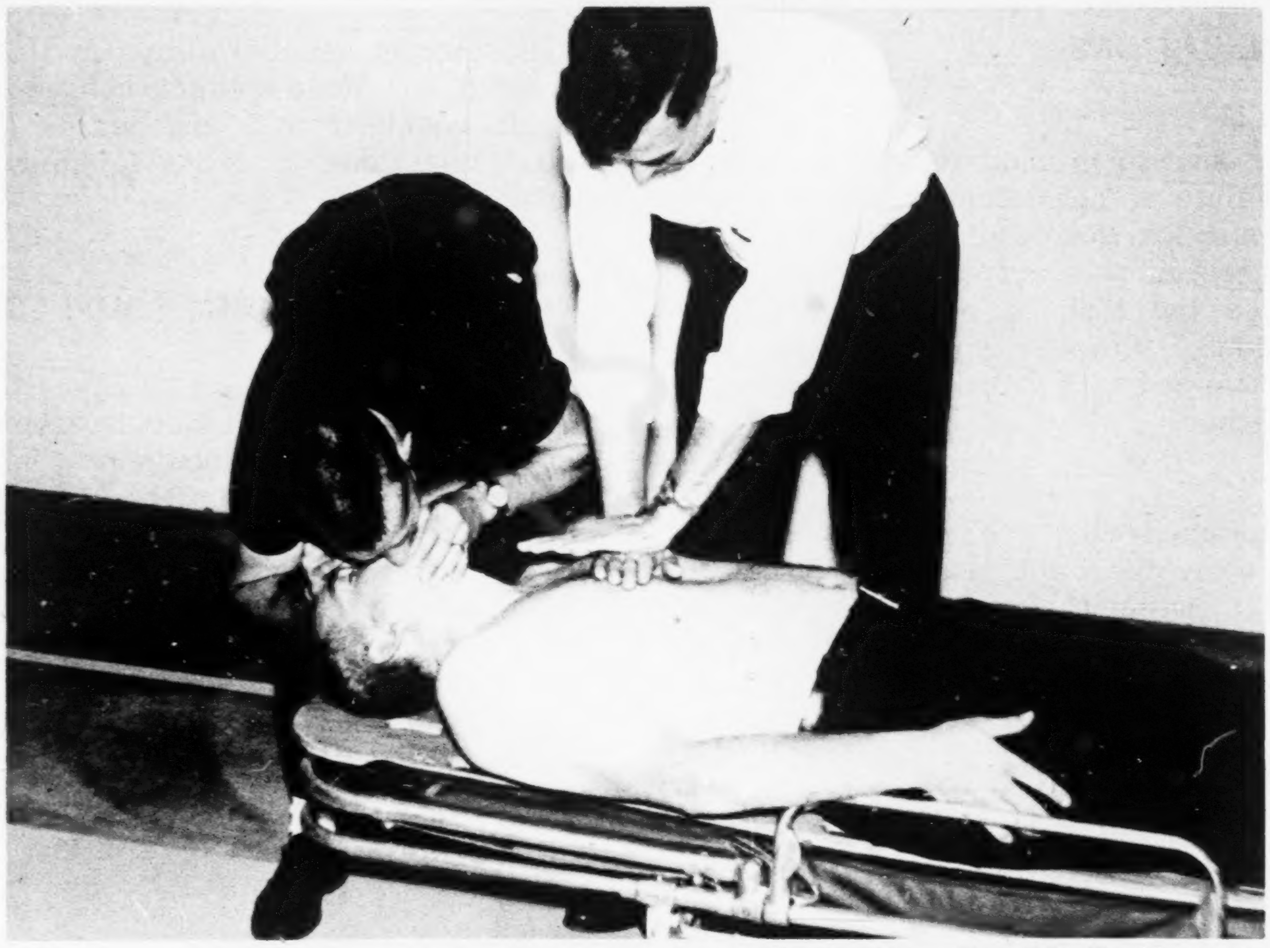
TRANSPORTATION

With the victim on a backboard, closed-chest heart compression and resuscitation can be carried out and continued while loading into the squad vehicle, and while en route to the hospital. (See Figures 9 through 11.).

The hospital to which the squad is en route should be notified of the patient's pending arrival. This will allow time for the emergency room team to prepare equipment and drugs before the victim arrives.

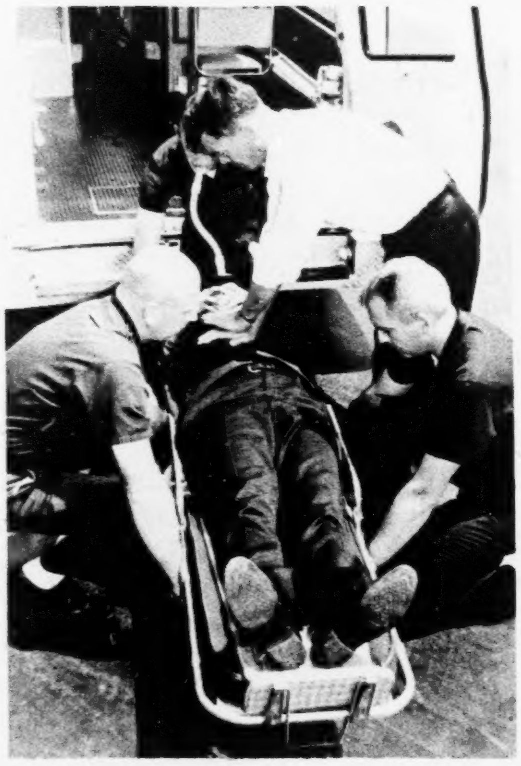
CONCLUSION

This resuscitation procedure can not be learned just by reading material in a text. Continual practice and experience are necessary. The procedure should be reviewed often.



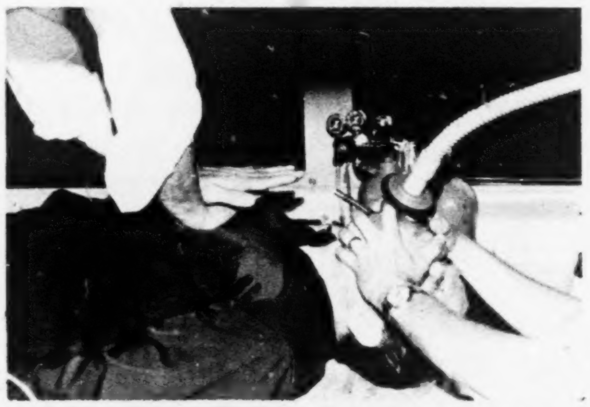
Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 9. With the victim on a backboard, both life-saving procedures can still be carried out.



Courtesy Sharon Twp. F.D., Worthington, O.

← FIGURE 10. Loading the victim into squad ambulance.



Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 11. Both procedures being continued in the squad ambulance.

CHAPTER XII

OXYGEN THERAPY

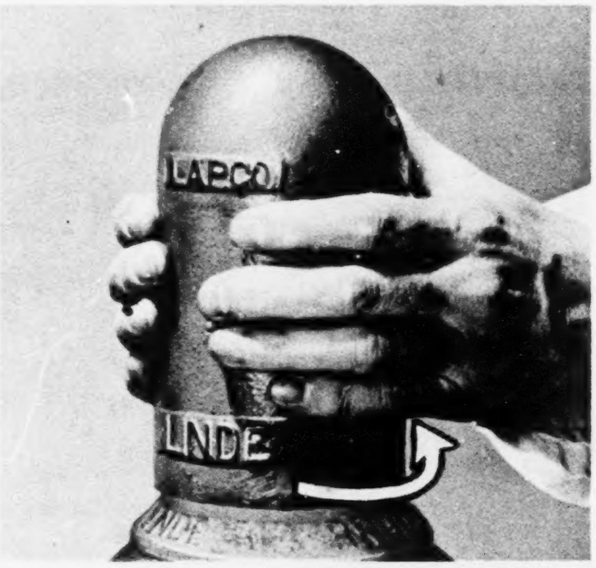
INTRODUCTION

Among the most basic equipment to be placed in the average emergency squad vehicle is the apparatus for administering oxygen. Many of the victims cared for by squadmen have a great need for highly concentrated oxygen. Alone or in support of other measures, it is important in emergency care of such conditions as heart attacks, severe burns, loss of blood, respiratory distress and shock. Oxygen administered with an inhalator or resuscitator can prevent the condition of a victim from becoming much worse, or may even ward off death.

BASIC PROCEDURE

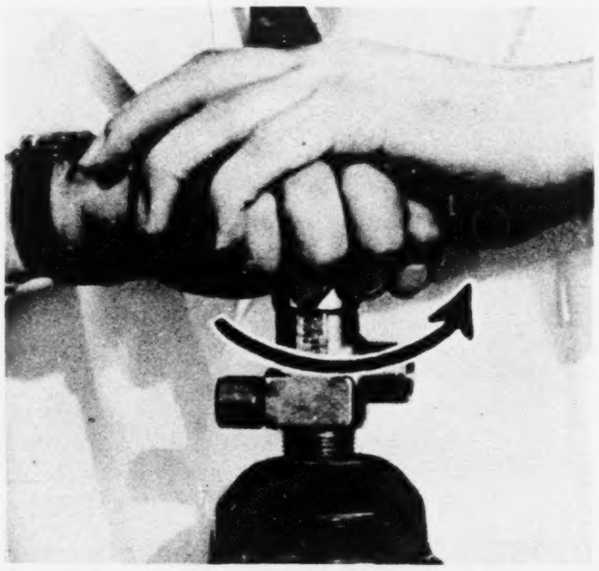
SETTING UP THE APPARATUS

In preparing a cylinder of oxygen for use, the protective cap must be removed (Figure 1). Then, with the valve outlet pointed away from the operator and with a firm grip on the cylinder, open the valve slightly (Figure 2); then close it quickly (Figure 3). This is called "cracking" the valve. This procedure removes dust which has lodged in the valve opening so it will not enter the regulator.



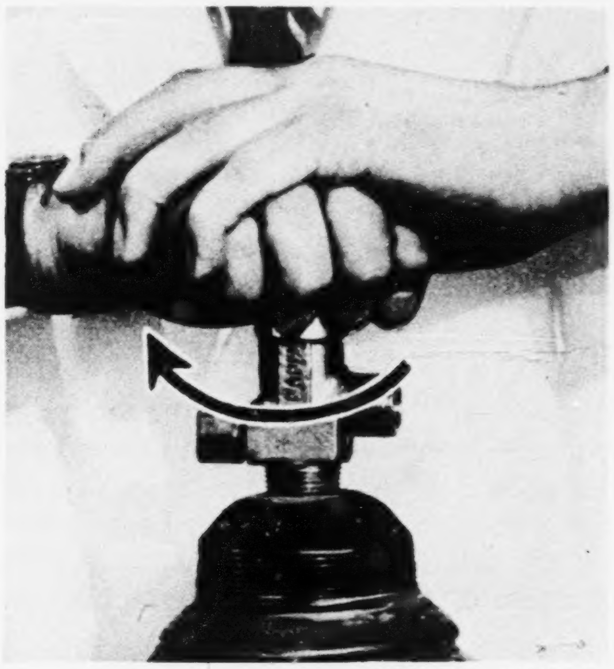
Courtesy Linde Co.

FIGURE 1. Remove protective cap



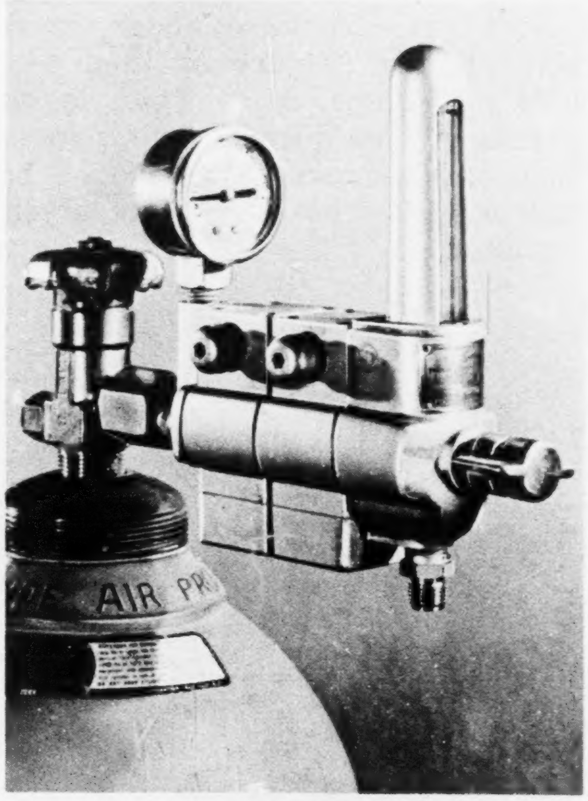
Courtesy Linde Co.

FIGURE 2. Open valve slightly



Courtesy Linde Co.

FIGURE 3. Close valve quickly



Courtesy Linde Co.

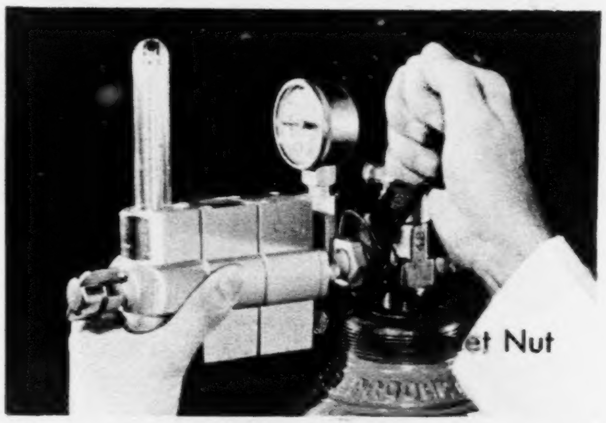
FIGURE 4. A pressure-reducing regulator must be attached to the cylinder before oxygen can be administered to the patient.

Reducing Pressure - When an oxygen tank is full, it is under a pressure of more than 2,000 pounds per square inch. Before the tank may be safely used, a pressure-reducing regulator must be attached. This will permit administering oxygen at a much lower pressure.

Controlling Flow - Figure 4 shows one widely used type of regulator. After the oxygen leaves the pressure-reducing valve, it flows through an adjustable flowmeter (Figure 4). This permits administering oxygen to a victim at the rate desired.

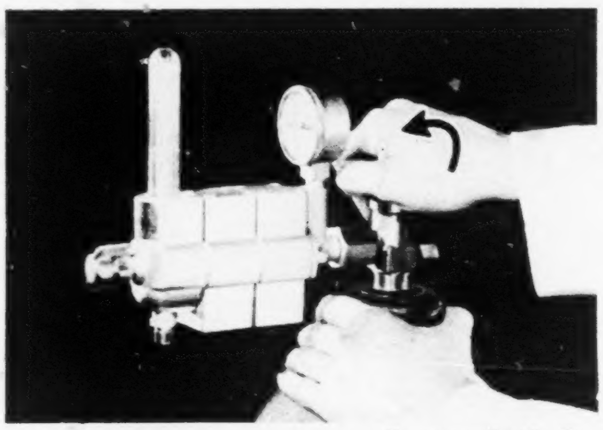
Figure 5 shows the regulator-flowmeter being attached to an oxygen tank. Figure 6 shows the regulator ready for use.

To administer oxygen, attach the administering apparatus to the regulator outlet and adjust the oxygen flow (Figure 7) to produce the desired concentration. To stop the flow for short periods--less than one-half hour--simply close the flow adjusting valve (Figure 8). Cylinder content will continue to register.



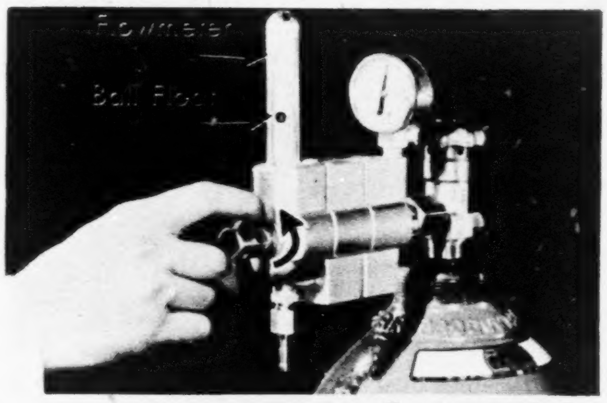
Courtesy Linde Co.

FIGURE 5. Insert regulator inlet in cylinder valve outlet and tighten the inlet nut with a wrench.



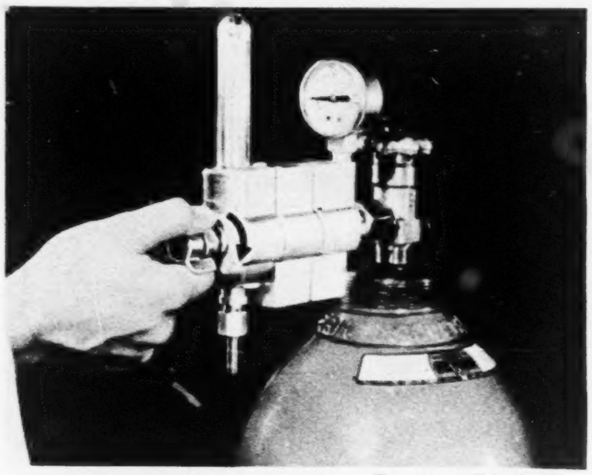
Courtesy Linde Co.

FIGURE 6. Stand to one side of the regulator, opposite relief valve, not in front or in back of it. Open cylinder valve very slowly, the slower the better, until needle on cylinder-contents gauge stops moving. The ball float will rise in the tube for a moment and then quickly return to zero. This indicates that oxygen has entered the flow indicator tube.



Courtesy Linde Co.

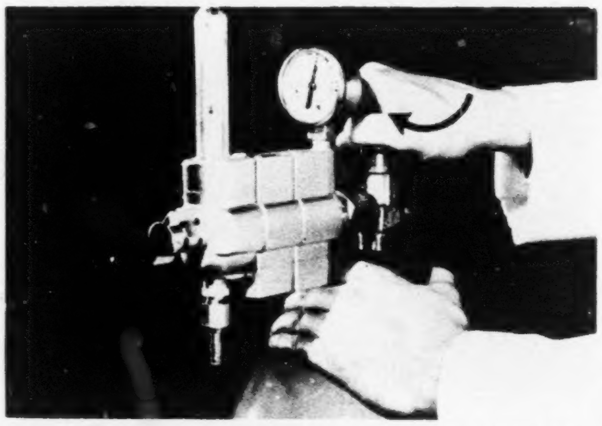
FIGURE 7. Open the flow-adjusting valve. The ball float will rise in the tube. The position of the top of the float indicates the rate of flow in liters per minute.



Courtesy Linde Co.

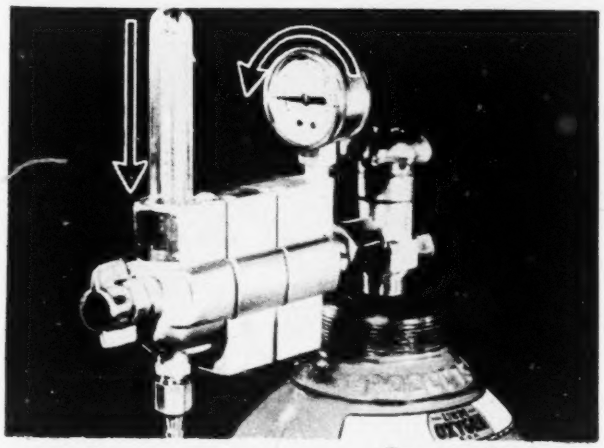
FIGURE 8. Stop flow by closing the flow-adjusting valve. The float will drop to zero.

When the flow of oxygen is to be discontinued for one-half hour or more, or when the regulator is to be disconnected from the cylinder, follow the steps outlined in Figures 9 and 10. Then close the flow-adjusting valve as in Figure 8.



Courtesy Linde Co.

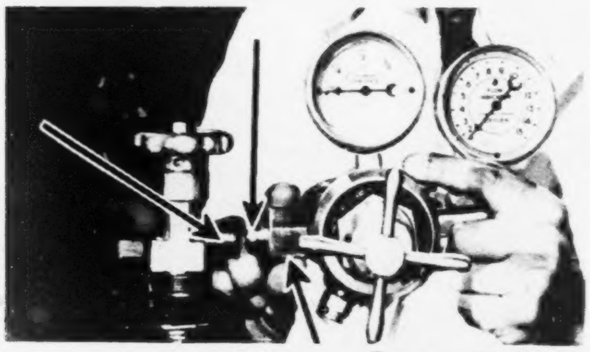
FIGURE 9. Close the cylinder valve tightly. Then open the flow-adjusting valve.



Courtesy Linde Co.

FIGURE 10. Wait until both cylinder-contents gauge and liter-flow indicator have returned to zero. Then close flow-adjusting valve.

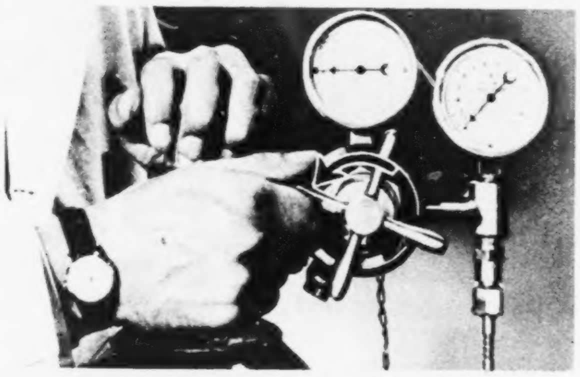
Cross-Arm Regulators - Another widely used type of regulator operates somewhat differently. It has two gauges; one shows cylinder contents and the other shows the rate of flow. Figure 11 shows how to install one of these regulators on a tank.



Courtesy Linde Co.

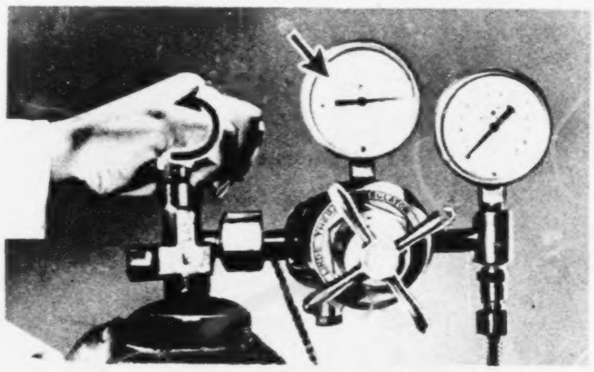
FIGURE 11. Insert regulator inlet into cylinder outlet and tighten inlet nut with a wrench.

Before oxygen is administered, the flow-adjusting handle must be loosened (Figure 12), and the cylinder valve must be opened very slowly (Figure 13).



Courtesy Linde Co.

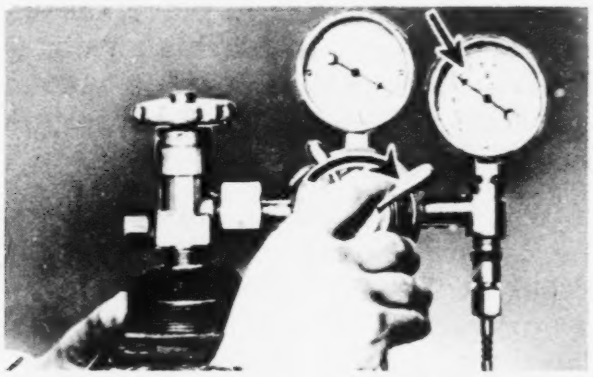
FIGURE 12. Loosen regulator flow-adjusting handle. This is important and should be done before opening the cylinder valve.



Courtesy Linde Co.

FIGURE 13. Stand on side of cylinder opposite regulator side. Do not face either front or back of regulator. Open cylinder valve very slowly until needle on cylinder-contents gauge stops moving.

To administer oxygen as needed, follow the directions under Figure 14.

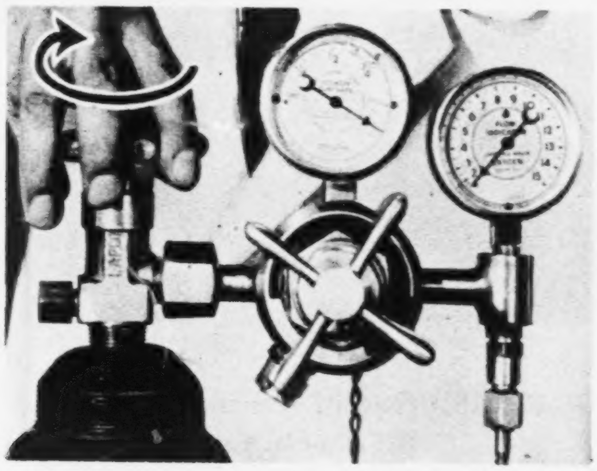


Courtesy Linde Co.

FIGURE 14. Tighten flow-adjusting handle by turning it to the right until the flow-indicator gauge registers the desired rate of flow in liters per minute.

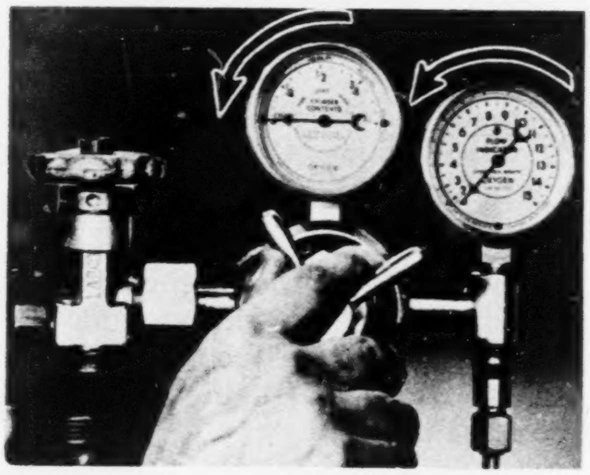
To stop the flow of oxygen for short periods--less than one-half hour--simply loosen the flow-adjusting handle by turning it to the left until the flow indicator returns to zero. Cylinder contents will continue to register.

When the oxygen flow is to be cut off for one-half hour or more, or when the regulator is to be disconnected from the cylinder, proceed as in Figures 15, 16, and 17.



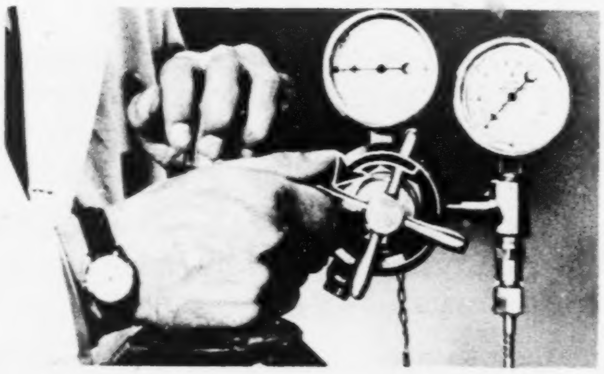
Courtesy Linde Co.

FIGURE 15. Close cylinder valve tightly. Then open the flow-adjusting valve.



Courtesy Linde Co.

FIGURE 16. Wait until both cylinder-contents and liter-flow needles have returned to zero.



Courtesy Linde Co.

FIGURE 17. Loosen regulator flow-adjusting handle. This is important and should be done before opening the cylinder valve.

ADMINISTERING OXYGEN

Methods - Oxygen may be given in four ways, using (1) full face mask, (2) catheter, (3) nasal cannula, or (4) tent.

A mask gives the highest possible concentration to the victim, and is the preferred method of administration by a squad. However, some victims have fear of the mask.

The next preference is use of the catheter. The catheter does not provide the highest concentration of oxygen, but the victim is more comfortable and is not frightened, as he may be by a mask.

Another method sometimes used is administration with nasal cannula. This method is least desirable due to the low percentage of oxygen available to the victim.

Few squads use tents. This method lends itself to use over long periods of time and needs close supervision; therefore, it is seldom used by squadmen.

The concentration of oxygen possible with each type of administering apparatus is as follows:

Mask -- approaching 100% concentration

Catheter -- 40% to 60% concentration

Nasal Cannula -- 30% to 50% concentration

Tent -- 40% to 60% concentration

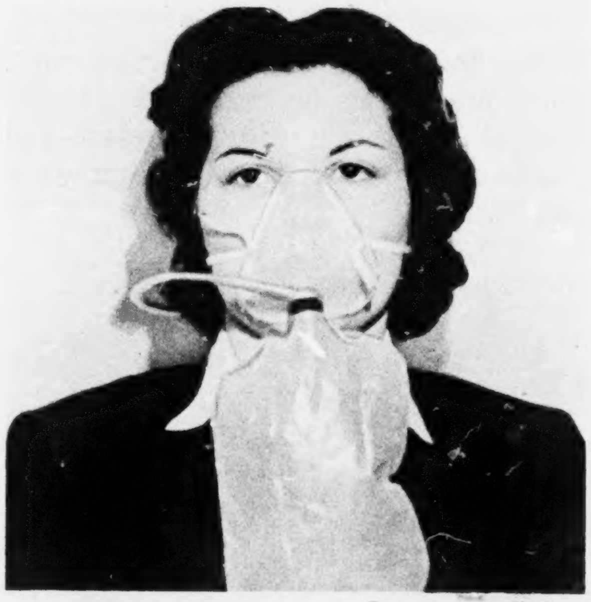
It can readily be seen that the use of a mask is the best method, since it provides the highest concentration of oxygen. An emergency squad need have no fear of over-oxygenating an acute victim.

It is important to overcome fear before a mask is applied. This can be done by letting the victim put the mask on himself or by letting him breathe a few times with it and then a few times without it.

After the mask is in place, the oxygen should be started at a high rate, so as to give the victim an ample amount to overcome the acute need for oxygen in the blood.

When a victim is inhaling oxygen, the breathing bag should never completely collapse. If it does, the amount of oxygen flow should be increased. Start the oxygen flow at 10 liters. It can then be adjusted up or down to meet the victim's need.

Disposable Masks -- Disposable face masks, such as the one shown in Figure 18, are available. There are partial-rebreathing and non-rebreathing types that operate in the same way as similar permanent masks. There are also face pieces without any rebreathing features. In all cases, follow the manufacturer's instructions. These light-weight plastic masks can be discarded after each use, saving the time ordinarily required for cleaning and sterilizing.



Courtesy Linde Co.

FIGURE 18. One of the many types of disposable masks now available.

MAINTENANCE OF EQUIPMENT

Masks - Soak all parts in a detergent-disinfectant solution for twenty minutes. Rinse thoroughly and dry.

Catheters - Wash rubber catheters thoroughly, with care given to the holes on the tip. These should not be obstructed. Soak catheters for twenty minutes in detergent-disinfectant solution. Rinse and dry. Wrap them in clean materials to be ready for later use.

The preferred catheter for squads is the plastic disposable type. Used only once, the cleaning problem is eliminated. It is also inexpensive.

Hospital emergency-room personnel often cooperate by exchanging a clean catheter for a soiled one. They have the proper facilities to sterilize rubber goods.

SAFE PRACTICES

All tanks should be held secure in the apparatus. The constant motion of the squad vehicle during calls will cause a dangerous situation if oxygen tanks are not held in place by straps, tank wells, blocks, or some other type of fixture.

DO'S AND DON'TS FOR SAFETY WITH OXYGEN CYLINDERS

"Crack" cylinder valve prior to attaching regulator by opening slightly and then closing again. This procedure blows dust and debris out of the cylinder valve opening.

Open cylinder valve slowly to give heat of compression a chance to dissipate.

Keep regulator inlet filter clean and intact to prevent lint from collecting on the valve seat. Replace as required.

Don't use oil or grease on oxygen equipment; combustion may occur.

Don't smoke or use open flame near oxygen. (Oxygen vigorously supports combustion.)

Have worn or frayed valve seat inserts replaced. They are much more subject to ignition when worn or frayed.

Don't use regulators and equipment that have been used with other gases; flammable residues may remain in these regulators.

Discourage repairs by unqualified personnel. If your equipment is worth repairing, it is worth repairing properly and safely.

Keep soap away from high pressure connections; it is flammable.

Don't use cylinders for hat trees or clothes racks. If there is a leaky connection, hanging clothes may ignite easily.

All oxygen tanks must have a pressure test (hydrostatic test) at least once every five years. All tested tanks have the date stamped on them. See Figure 19. Oxygen distributors will test tanks at a minimal cost.

Many squads fill smaller tanks from larger tanks. These smaller tanks must have the hydrostatic tests within a five-year period.

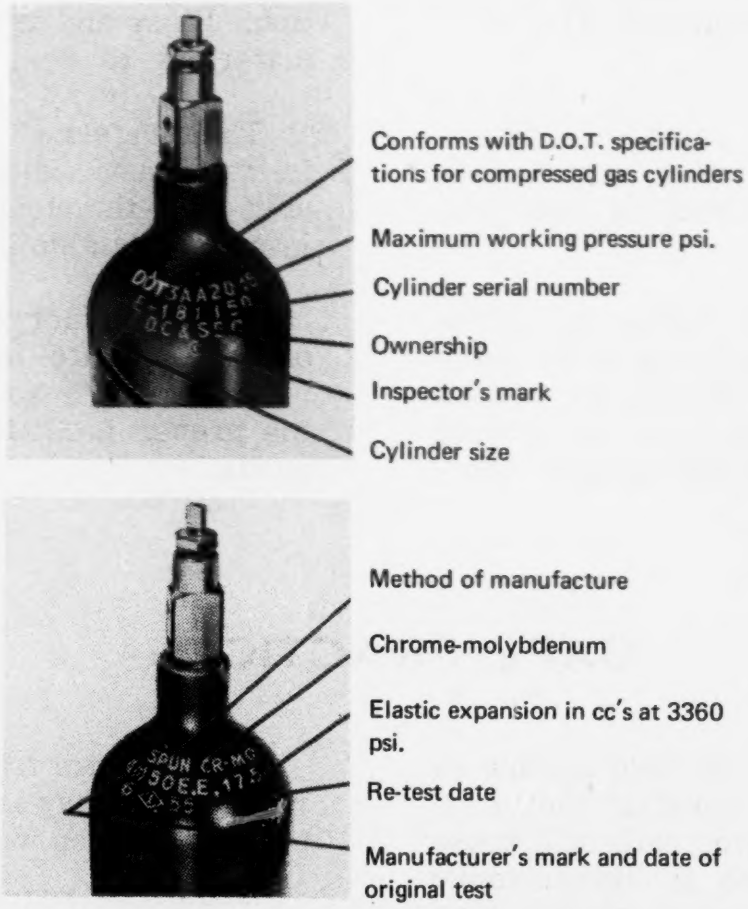

Conforms with D.O.T. specifications for compressed gas cylinders
Maximum working pressure psi.
Cylinder serial number
Ownership
Inspector's mark
Cylinder size
Method of manufacture
Chrome-molybdenum
Elastic expansion in cc's at 3360 psi.
Re-test date
Manufacturer's mark and date of original test

FIGURE 19. Information and specifications that are stamped on all oxygen and other compressed gas cylinders.

MASS EMERGENCY OXYGEN THERAPY

In a special emergency, oxygen in substantial quantities may be required to care for large numbers of victims. It is not expected that local hospitals or squads will have on hand enough oxygen-therapy equipment or oxygen to take care of such an emergency. Therefore, supplemental equipment and oxygen will be required.

COMMERCIAL SOURCES

Oxygen is available from distributors of oxygen, oxygen-producing plants, industrial plants, welding shops, automobile repair shops, scrap yards, and oxygen-therapy rental services. See the yellow pages of your telephone directory under "Oxygen".

NOTE: Cylinders of oxygen obtained from the above sources may not be as clean outwardly as cylinders prepared especially for medical use, but their contents will be U.S.P. oxygen unless stated differently on the cylinder. Be sure that the word "oxygen" is on the cylinder. Cylinders of similar size, shape, and color might contain other gases that would be harmful.

Pressure-reducing regulators must be used on all high-pressure cylinders of oxygen. Hospital-type regulators and other oxygen-therapy equipment, such as tents, masks, and catheters, can be obtained from the manufacturers of such equipment and oxygen-therapy rental services. Regulators of the industrial type can be obtained from most of the places where oxygen is available. See the yellow pages of your telephone directory under "Oxygen".

NOTE: Industrial-type regulators differ from hospital-type regulators in that they do not have a restricted outlet and are calibrated in pounds per square inch instead of liters per minute. However, such regulators can be used in an emergency by opening the control valve very slightly, or by attaching a liter-flow adapter to the regular outlet. Liter-flow adapters can be obtained from suppliers of hospital regulators.

IMPROVISED EQUIPMENT

1. Oxygen can be administered by inserting a piece of tubing or welding hose through the bottom of an ordinary paper bag and holding the top of the bag over the victim's face. Use a generous flow of oxygen.

2. Make a cone of cardboard, old X-ray film, stiff paper, or similar material. Insert the oxygen hose through the bottom of the cone and hold the top over the victim's face.

3. In a cardboard carton about twenty inches square, cut a hole about nine inches in diameter in the center of the bottom. Slide the victim's head through the hole. Insert the oxygen hose through the side of the carton opposite the victim's head. Leave the top of the carton open or cut the top off entirely.

EMERGENCY HELP

Persons familiar with oxygen and equipment can be located at any of the places where oxygen is available. These persons are not necessarily familiar with oxygen-therapy techniques but they should understand the mechanics of attaching a regulator to a cylinder.

CHAPTER XIII

BLEEDING CONTROL

INTRODUCTION

Bleeding is one of the most dramatic emergencies necessitating prompt care. It is imperative that the squadman act promptly and efficiently. Loss of blood is a dangerous condition that can quickly cause death. Abscense of breathing is the only condition that would take priority over bleeding control. However, absence of breathing and serious bleeding are both of such great importance that, whenever possible, one squadman should take care of one condition while another squadman attends at once to the other.

DEFINITION

Bleeding, or hemorrhage, is the escape of blood from arteries, veins, and capillaries through a break in their walls. Discharge of blood from the vessels, either external or internal, must be considered abnormal.

FACTS CONCERNING BLOOD AND BLEEDING

One-twelfth to one-fifteenth of body weight is blood. This would amount to ten to twelve pints in an individual weighing 150 pounds. The loss of one pint of blood usually produces no harmful effects; the loss of approximately three pints will cause shock. The cutting of the major blood vessels of the neck, arm, or thigh can cause bleeding so severe that death results between one to three minutes. Rupture of the main trunk artery or vein may result in fatal bleeding within thirty seconds.

Severe or uncontrollable bleeding from a wound or injury that usually would not warrant such hemorrhage should alert the squadman to suspect that the victim may be a "bleeder" (hemophiliac).

Hemophilia or "bleeder's disease" is the result of the victim's blood failing to clot due to a deficiency or chemical change within the clotting mechanism. This is a hereditary condition transmitted from the female to her male children. The female herself seldom suffers from this disease. Most victims of this disease carry a medic-alert emblem.

BLEEDING CLASSIFICATION IN REFERENCE TO TIME

Primary Bleeding: Occurs at the time of injury.

Consecutive Bleeding: Occurs some time after an injury or in the case of surgery, 12 to 48 hours after the operation.

Secondary Bleeding: This is a hemorrhage that occurs after a 48-hour period, up to the time of complete healing.

BLEEDING CLASSIFICATION IN REFERENCE TO SOURCE

Arterial Bleeding: Is bright red in color, and appears in spurts with each heart beat, unless the torn or severed artery is deep. Arterial bleeding is very rapid and the most difficult to control.

Venous Bleeding: Is dark red in color, and presents itself in a steady flow under low pressure. Though not as dramatic as arterial bleeding, its steady flow can be equally dangerous if unchecked. Venous bleeding is almost always controllable by applying a snug pressure dressing. Elevation of the bleeding part will assist in stopping the more profuse bleeding.

Capillary Bleeding: Has an intermediate color and just oozes from the minute vessels of the wound. Capillary bleeding is easily controlled using a sterile compress applied with bandages.

SYMPTOMS OF BLEEDING

External bleeding can be seen and is easily recognized. Internal or concealed bleeding is difficult to determine and to identify. Concealed bleeding is usually the result of heavy blows or crushing injuries that damage the internal organs. Victims of some minor automobile accidents may suffer serious internal bleeding due to their being thrown against the steering wheel.

Whether bleeding is external or internal, the symptoms will be the same, and their degree will depend on the amount and speed of blood loss.

Any number of the following signs/ symptoms may be present:

1. The skin will be pale, moist and clammy.

2. Body temperature is below normal.

3. Pulse is fast, weak, and irregular.

4. Pupils of eyes will dilate and reaction to light will be slow.

5. Ringing in ears (tinnitus).

6. Faintness or actual fainting (may be the first symptom of internal hemorrhage).

7. Complains of thirst (dehydration).

8. Breathing is fast, shallow, and gasping (air hunger).

9. Apprehension and restlessness.

10. Loss of consciousness with stoppage of breathing.

11. Shock will always be present to some degree.

EMERGENCY CARE

EXTERNAL BLEEDING

Prompt and decisive measures must be taken in all emergencies involving hemorrhage. There are five methods of bleeding control: (1) direct pressure, (2) elevation, (3) cold applications, (4) digital pressure, and (5) the tourniquet.

Direct Pressure: This is the method of choice in over 90 percent of all bleeding. Regardless of the bleeding source, pressure is applied directly to the wound with a sterile compress and held in place with a snug bandage (pressure dressing). See Figure 1.

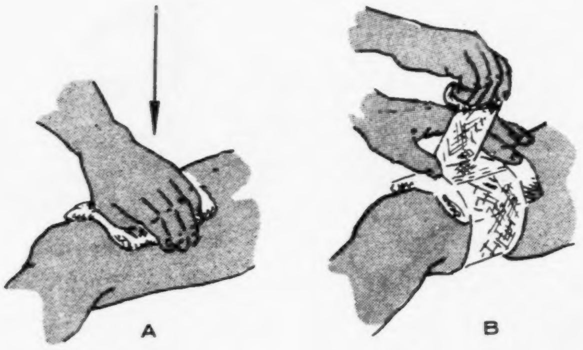


FIGURE 1. Direct Pressure to Control Bleeding. A, Direct hand pressure over bleeding point to control hemorrhage; B, Application of snug bandage to maintain pressure.

Elevation: In wounds or injuries to an extremity, apply a pressure dressing and elevate the part. The force of gravity retards the flow of blood, and continued elevation will stop the bleeding.

Cold Applications: The use of cold compresses or cold packs for nose bleeds and other suspected internal bleeding will check capillary bleeding and some venous bleeding. In contusions, cold applications will prevent discoloration.

Prolonged use of cold packs is to be avoided, for it will retard circulation and may lead to tissue damage.

Digital Pressure: Pressure on the pressure points will control arterial bleeding to the area supplied by that artery. Though pressure points are seldom used, they should be learned by all squadmen. There are occasions when the bleeding part is in an area not accessible for direct pressure. Then the bleeding should be controlled by a pressure point until the part is freed, and bleeding can be controlled by a pressure dressing. Figure 2 should be carefully studied, and the points where arteries can be compressed against bony surfaces should be memorized.

The Tourniquet: The application of a tourniquet has been the topic of many discussions leading to a certain degree of controversy. The best advice may be to never use the tourniquet, yet there are those isolated cases of complete limb destruction or amputation with severe bleeding that can only be controlled with this method.

The use of a tourniquet can only be considered when all other methods of bleeding control fail. When the decision is made to use it, always place it between the wound and the heart, and as close to the wound as possible. Once applied it must not be removed until the victim is within a medical facility and a physician is in attendance.

A tourniquet is a constricting band which can be placed around an extremity and tightened until all arterial blood flow stops. Tourniquets may be made from rubber tubing, a webbed strap, a cravat, or any one of many commercial types on the market. In emergency care it is recommended that only an improvised tourniquet be used. It is made by preparing a cravat bandage as shown in Figure 3.

The tourniquet should be tight enough to stop the bleeding. If it is too tight it may damage muscles, nerves, and blood vessels. The limb below the tourniquet should appear pale, the pulse in the limb beyond the tourniquet must disappear. If the tourniquet is not tight enough, it will compress the veins and yet not stop the arterial flow. The limb then continues to be filled with blood and it cannot escape or return through the veins. As a result, it will bleed more rapidly through the wound. If the tourniquet is too narrow, it will damage the limb.

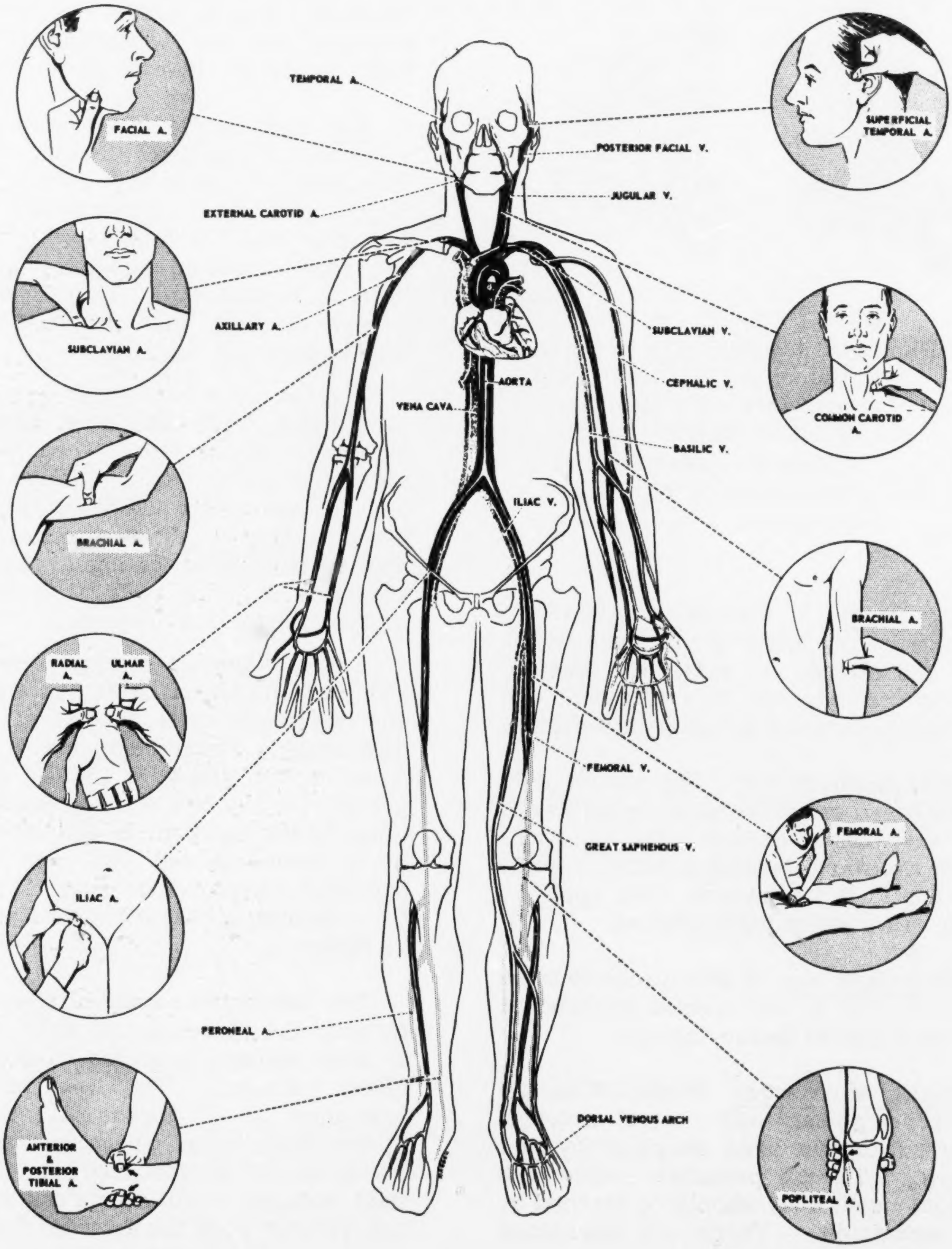

FACIAL A.
TEMPORAL A.
SUPERFICIAL TEMPORAL A.
POSTERIOR FACIAL V.
EXTERNAL CAROTID A.
JUGULAR V.
SUBCLAVIAN A.
AXILLARY A.
SUBCLAVIAN V.
CEPHALIC V.
AORTA
VENA CAVA
COMMON CAROTID A.
BASILIC V.
ILIAC V.
BRACHIAL A.
BRACHIAL A.
RADIAL A.
ULNAR A.
FEMORAL V.
FEMORAL A.
GREAT SAPHENOUS V.
ILIAC A.
PERONEAL A.
DORSAL VENOUS ARCH
ANTERIOR & POSTERIOR TIBIAL A.
POPLITEAL A.

FIGURE 2. Pressure Points - At the indicated points, arteries are close to the surface and/or they can be compressed against an adjacent bone surface.

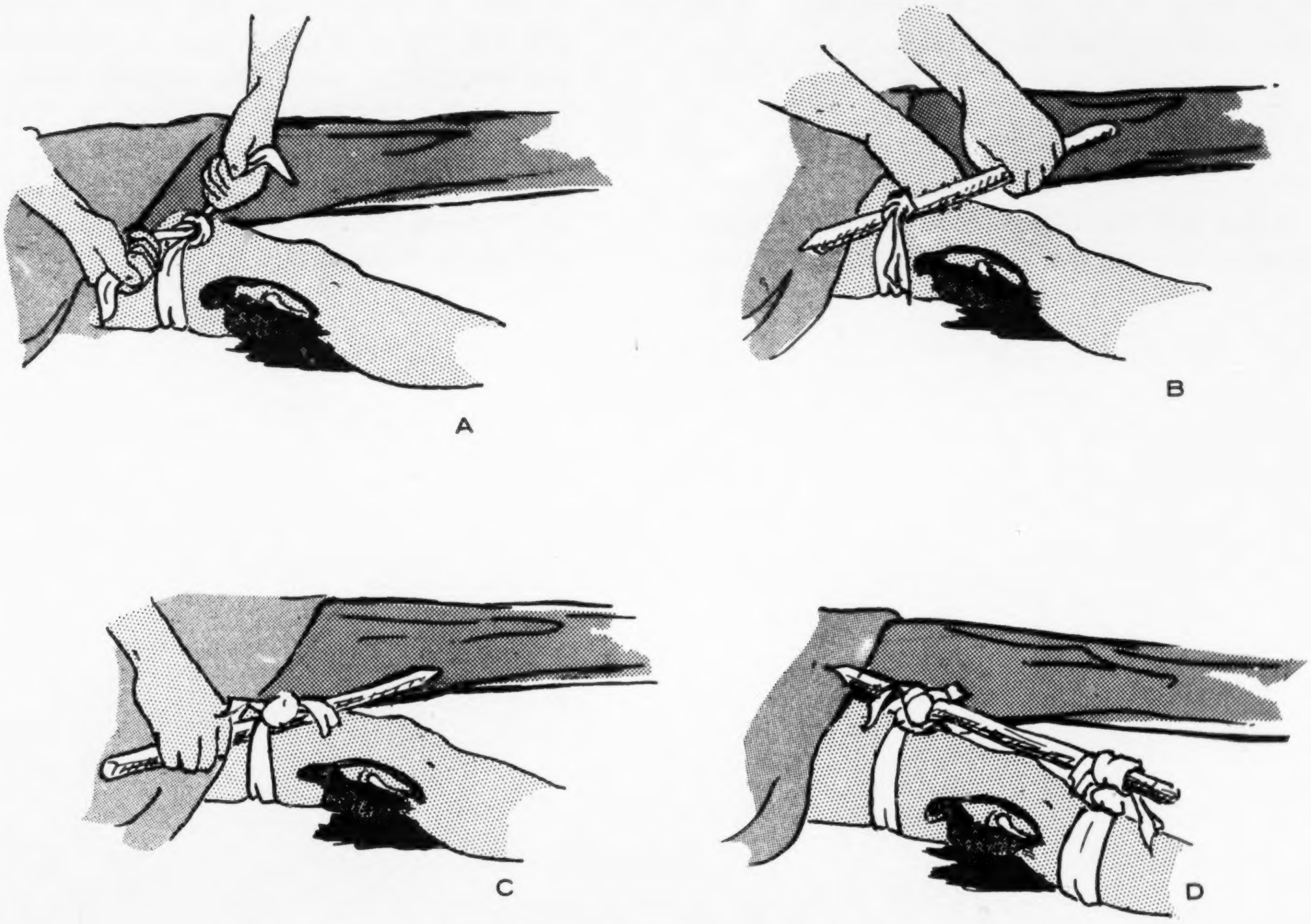


FIGURE 3. Application of Improvised Tourniquet. A, Wrap cravat bandage around the extremity and tie an overhand knot; B, Put stick over first knot; C, Tie 2nd knot, and twist stick to tighten tourniquet; D, Secure stick in position by tying another strip of material about extremity. To discourage the use of the tourniquet it is recommended that only improvised material be used. This will prevent the mis-use and possible over-use of accessible commercially made devices.

Tourniquets have been applied and forgotten and the extremity covered with bandages. To avoid such a situation the victim should be tagged or marked to indicate the location of the tourniquet and the time it was applied.

INTERNAL BLEEDING

Internal bleeding includes many different kinds of blood loss. The usual reference is to injuries or ailments where there is an escape of blood into the tissues, or into the body cavities. Internal bleeding occurs frequently as a result of injuries received in auto accidents, falls, kicks, explosions and from other physical or mechanical forces.

Symptoms (See Page 132):

Internal bleeding should always be suspected in victims that exhibit severe shock; weak, rapid, irregular pulse, with no obvious injuries. The victim may be conscious or unconscious.

Emergency Care:

Internal bleeding can only be controlled by surgery. Cold applications to the suspected area may have some effect in retarding the flow of blood, but extreme cold for long periods should be avoided. Lay the victim down and treat for shock as outlined in Chapter XIV. Transportation to a medical facility is imperative, but caution must be exercised to prevent aggravation of the victim's condition.

CHAPTER XIV

SHOCK

INTRODUCTION

Shock is a serious condition frequently occurring in victims of injury or serious illness, and should be given prompt attention. Only the control of breathing and bleeding has priority over the treatment of shock. Treatment of the cause is the most effective means to alleviate progression of shock. At the present time, there is no actual treatment that the squadman may apply. He will follow the first aid procedures for shock as has been taught by the many agencies, but his treatment of the cause will be the best emergency care for this condition.

The squadman will not have the capability to actually treat shock at the scene and during transport until he has been properly trained to give intravenous fluids.

DEFINITION

Shock is a state of collapse or depression that interferes with the normal action of the heart, respiration, and circulation. This condition will occur in one degree or another as a result of injury, illness, or a sudden mental disarrangement.

TYPES OF SHOCK

Shock can be classified as to type, namely, oligemic (blood loss, wounds, burns, etc.), neurogenic (pain, emotional upset, fear, horror) cardiorespiratory (impaired circulation and breathing), and anaphylactic (stings from bees, wasps, drug sensitivity). More than one type of shock may be present to varying degrees in the same victim. Generally the word shock refers to oligemic shock (wound shock), the type most frequently encountered and the most important for the squadman to understand.

OLIGEMIC SHOCK

This condition is also known as secondary, delayed, surgical, traumatic, or wound shock. Burn shock and bleeding shock are varieties. The outstanding characteristic is a decrease in the volume of circulating blood that may be caused by:

1. Direct loss of blood as in external or internal bleeding.

2. Loss of plasma of the blood by seepage into tissues at the site of burns, contusions, and crush injuries.

3. Loss of fluids from the intestinal tract in severe vomiting, diarrhea, or other intestinal disorders. This loss dehydrates the body and decreases the circulating blood volume as well.

As an example, it has been estimated that in a fracture of the femoral shaft (thigh bone) there is a loss of approximately two pints from the volume of circulating blood. A part of this loss is from bleeding into surrounding tissues and a part is from seepage and loss of plasma and other fluids into the damaged soft tissue around the fracture.

In shock, the reduced blood volume causes a decrease in the heart output and reduces the overall circulation. This results in a lowered amount of oxygen being delivered to the body tissue and a lowered transport of waste products away from the tissue cells. The tissue cells in turn react by producing an abnormal amount of waste products, which can cause a severe chemical reaction.

Early recognition and treatment of shock results in a great degree of success. But if treatment is delayed and tissue destruction progresses, it then becomes more difficult to obtain recovery in spite of intensive treatment. Whenever the blood pressure drops below a certain level, the kidneys become unable to produce urine. If low blood pressure of this degree (60 to 80 systolic) exists for longer than a brief period, kidney shutdown may continue even after the blood pressure is returned to normal levels. This is a serious complication that may result in death.

Prolonged shock can also cause serious effects on the brain, heart muscle, and liver. Complete knowledge of the cause and complications of shock will enable the squadman to understand the importance of early, effective emergency care.

SIGNS AND SYMPTOMS

Shock should be expected in all victims who have severe bleeding, abdominal or chest injuries of any type, crush injuries, all major fractures both simple and compound, amputations, burns, or any severe wound or injury found anywhere in the body. The symptoms of shock will vary, and those listed below do not appear in every victim. An evaluation of the extent and severity of the combined injuries is more important than any one particular sign or symptom. It is most important to suspect and care for shock before the distinct symptoms develop. The following represent the wide variety of signs and symptoms that may be presented by the victim in shock:

1. Eyes may be glassy, lack luster, have dilated pupils, or suggest fear and apprehension.

2. Breathing may be rapid or labored. In advanced stages, the breathing becomes shallow and irregular.

3. The lips may be pale or have a bluish-gray color (cyanotic).

4. The skin may be pale or ashen gray; in the dark-complexioned the mucous membranes help to identify shock.

5. Skin temperature may be lowered, and the body covered with a clammy sweat.

6. The pulse may be rapid, weak, thready, and of poor volume. In victims who have lost a considerable amount of blood, it may be difficult to find a pulse.

7. There may be retching, nausea, vomiting, and dryness of mouth, lips, and tongue.

8. Frequent complaints of thirst. Shock victims may complain of thirst rather than pain, even though severely wounded.

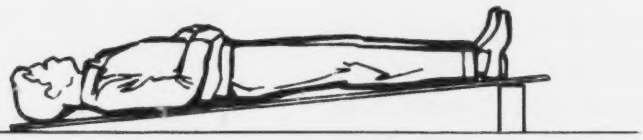
9. Restlessness and apprehension are usual symptoms.

10. Victim may be partly or totally unconscious.

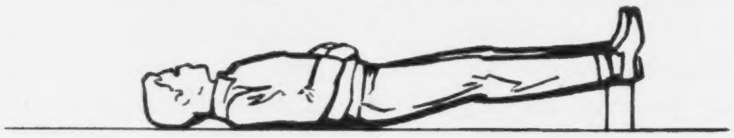
EMERGENCY CARE

In oligemic shock, the most important requirement is to stop and reverse the progression by restoring the circulatory blood volume. Only when circulatory volume has been restored can improvement and recovery from shock be expected. Eventually all emergency medical personnel will be trained to take blood pressure and to give intravenous fluids. However, the following general measures should be applied to all victims in shock regardless of I.V. fluids.

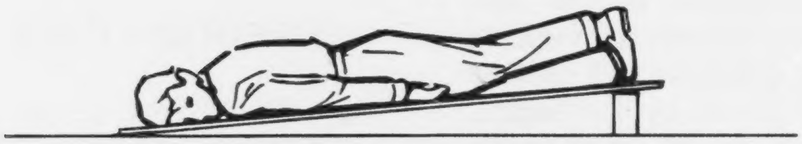
1. Treat the cause. Control all bleeding, and bandage all wounds. Splint all fractures to avoid further damage and aggravation.
2. Reassure the victim.
3. Support with oxygen.
4. Conserve body heat. Make sure the victim is covered both over and under the body. Remove wet clothing to eliminate rapid cooling from evaporation. Always consider the temperature of the environment so as not to induce sweating. Artificial means of heating (hot water bottles, hot brick, etc.) are not indicated because it causes dilation of the surface blood vessels that further deplete overall circulation.
5. Position: Place the victim in a supine position (flat on back) with the legs elevated 10 to 12 inches. The squadman must be careful not to slant the entire body. See Figure 1. When the entire body is put on a slant, the abdominal organs and contents press against the diaphragm causing breathing to be more difficult. If face, jaw, mouth or throat injuries produce bleeding



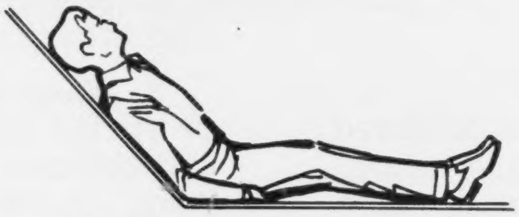
SHOCK POSITION - NO



SHOCK POSITION - YES



ASPIRATION POSITION



POSITION TO EASE RESPIRATION

FIGURE 1

into the upper air passage, the victim must then be placed in a prone position (on stomach) with the head turned to one side and the foot of the stretcher raised 6 to 12 inches to prevent aspiration of blood and other matter into the lungs. If there is a head or chest injury, stroke, or difficult breathing, the victim should be positioned with the head and shoulders elevated.

6. Fluids: No fluids are to be given by mouth to the unconscious victim or to the victim that will undergo immediate surgery. The shock victim may repeatedly complain of thirst, this can be alleviated somewhat by moistening his lips with a wet cloth, and offering continued reassurances.

NEUROGENIC SHOCK

Neurogenic shock is a result of the disarrangement of the autonomic nervous system (the system which controls the internal organs, heart, blood vessels, smooth muscles, and glands). This disarrangement brings about a widespread dilation of the blood vessels and capillaries. Thus after painful injury, emotional upset, fear or horror, etc., the blood leaves the active circulation because of this dilation and pools primarily within the organs of the abdominal cavity. This reduces the volume of blood in actual circulation and causes a drop in output of blood by the heart. This is the usual cause of fainting or loss of consciousness.

SIGNS AND SYMPTOMS

Neurogenic shock may be indicated by yawning, fainting, vomiting, sweating, pallor, waning consciousness, slow pulse, and deep sighing respiration. In severe cases, due to the lack of brain circulation, the victim may convulse.

EMERGENCY CARE

Simple fainting is the mildest form of neurogenic shock. This can be treated by placing the victim in a supine (on back) or prone (on stomach) position with the head and chest slightly lower than the feet. All tight clothing should be loosened. A few whiffs of an ammonia inhalant may be given and may prove helpful. In severe cases, maintain an open air passage and support with oxygen. If the victim is convulsing, protect him from injury by protecting his head and controlling his motions, but do not restrain him.

CARDIORESPIRATORY SHOCK

Shock of cardiorespiratory origin is caused by airway obstruction, sucking chest wound, flail chest, heart attack, and other disorders of the heart and lungs. All of these conditions produce shock through a lack of oxygen which causes a collapse of circulation.

SIGNS AND SYMPTOMS

The signs and symptoms of the causes listed above, plus those of oligemic shock will be present in one degree or another. In respiratory distress the blood is circulating but it is very low in oxygen, and inadequate circulation is the result of a heart attack or heart disease.

EMERGENCY CARE

Treatment of the cause is the most effective care that can be administered.

1. Maintain an open airway and support with oxygen.

2. When the victim has a crushed or flailed chest, the chest wall must be immobilized; and while this is being done, maintenance breathing must be given. This can be provided by mouth-to-mouth, bag mask, or a manually triggered oxygen device.

3. In addition, the measures for the treatment of oligemic shock are indicated.

ANAPHYLACTIC SHOCK

Unlike other types, anaphylactic shock is not the result of injury or illness. It is the result of an individual's being overly sensitive to insect bites, such as bee and wasp stings, drugs and other medications, or from certain foods.

SIGNS AND SYMPTOMS

A history of the victim's medical condition and recent activities may be the best indication as to the cause and possible care. In severe cases, the following symptoms may be exhibited:

1. Respiratory distress, difficult breathing due to swelling of the vocal cords.

2. Mottled, livid and blue appearance of the skin.

3. Severe headache.

4. Rapid loss of consciousness.

Even if the above symptoms are not present, the victim will appear to be in deep shock with swelling of the abdomen, nausea, vomiting, and diarrhea.

EMERGENCY CARE

Anaphylactic shock must be considered an emergency situation, and prior notification to the hospital is warranted.

1. Maintain an open airway and support with oxygen.

2. Place victim in a semi-reclining position to ease respiration.

3. For insect bites, place a tourniquet between the sting and the heart, and remove the stinger.

4. Provide prompt, careful transportation to a hospital, for only there can this condition be treated properly.

CHAPTER XV

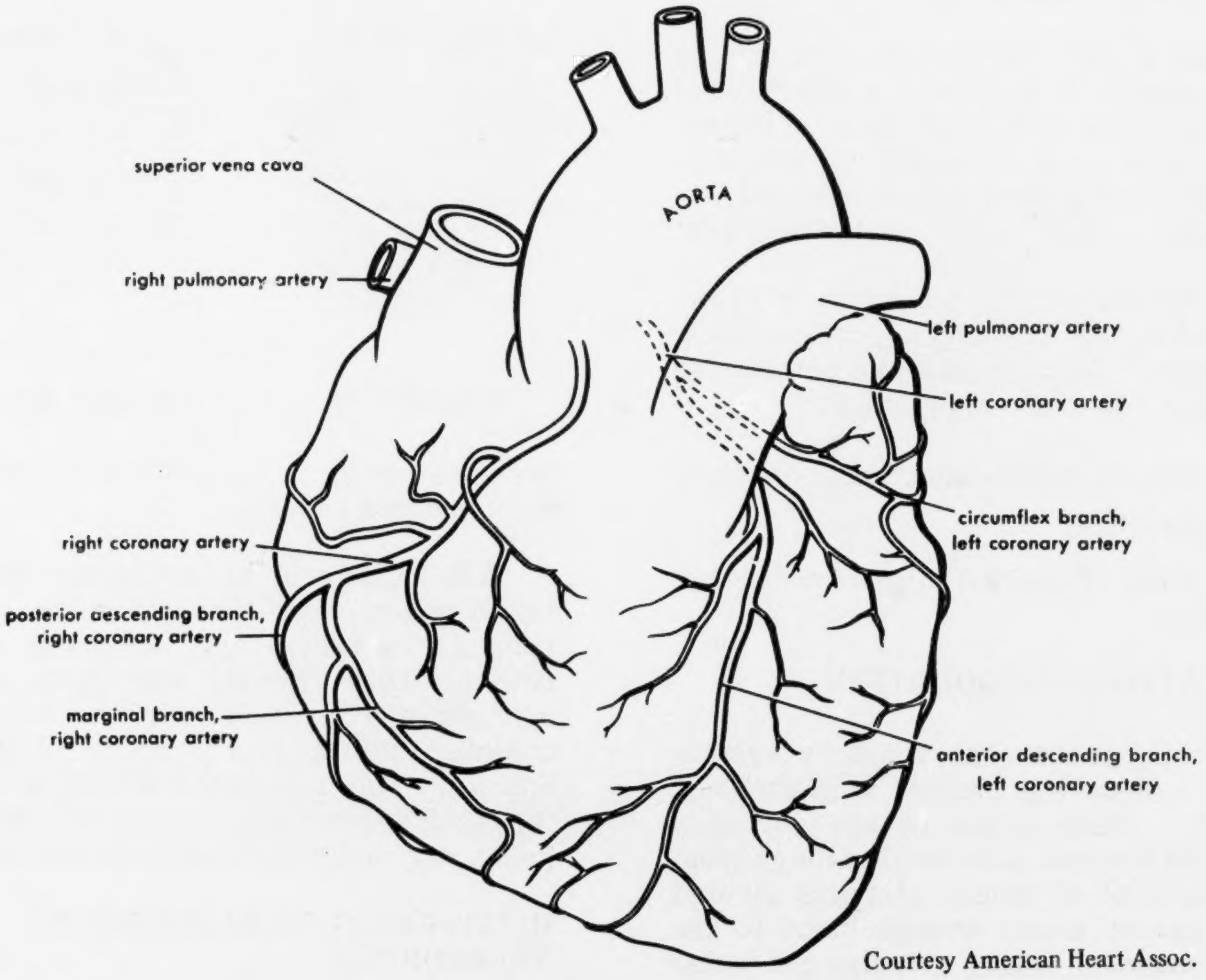
MEDICAL EMERGENCIES

GENERAL INFORMATION ABOUT HEART ATTACK

CORONARY THROMBOSIS

Usually a "heart attack" means an acute condition that doctors call coronary thrombosis. It is a sudden blocking of one of the coronary arteries: the arteries that supply the heart muscle with blood. (See Figure 1.)

Although a heart attack itself is sudden, it is the result of atherosclerosis: a slowly developing disease process of the coronary arteries. Atherosclerosis causes most heart attacks and the chest pain called angina pectoris. It is a form of arteriosclerosis (hardening of the arteries).


AORTA
superior vena cava
right pulmonary artery
left pulmonary artery
left coronary artery
circumflex branch, left coronary artery
right coronary artery
posterior descending branch, right coronary artery
marginal branch, right coronary artery
anterior descending branch, left coronary artery

Courtesy American Heart Assoc.

FIGURE 1. The main coronary arteries with their many branches come down over the top of the heart like a crown (corona) and send tinier branches or twigs down into all parts of the heart muscle to supply it with oxygen-carrying blood.

In atherosclerosis, the passageway through the arteries becomes roughened and narrowed by fatty deposits that harden into patches along the inner lining of the artery. This process has been compared to the formation of lime deposits in a water pipe. Around the patches scar-like fibrous tissue forms in the artery wall so that the channel is narrowed and there is less room for blood to flow through. (See Figures 2A and 2B.)

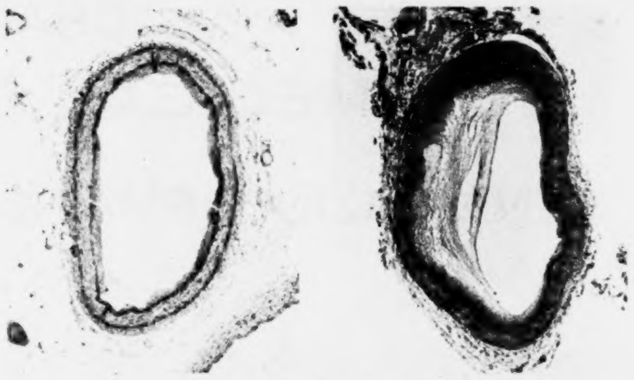
A blood clot can form in an artery narrowed by atherosclerosis. This blocks the channel and cuts off the blood flow to the part of the heart supplied by the artery. (See Figures 3A and 3B.)

When a clot (thrombus) cuts off the blood supply to a section of heart muscle, the result is a heart attack. Physicians call it a coronary thrombosis, coronary occlusion, or myocardial infarction. The usual symptoms are:

1. Severe painful sensation of pressure under the breastbone, often lasting for hours. (Mild attacks are sometimes mistaken for acute indigestion.)
2. Sudden intense shortness of breath.
3. Sweating.
4. Loss of consciousness (occasionally).

COLLATERAL CIRCULATION

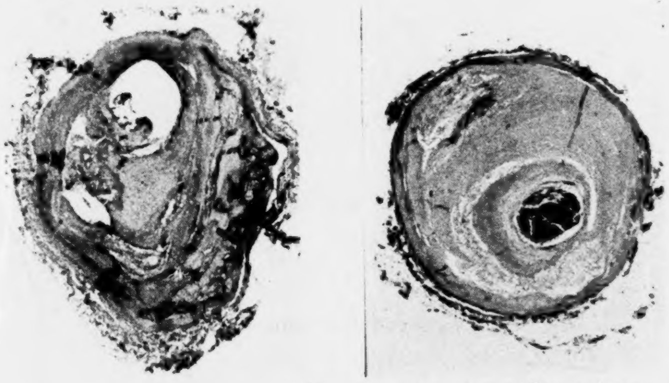
Luckily the coronary artery system has a life-saving method of growth and repair. When some of the coronary arteries become narrowed by the gradual development of atherosclerosis so that they cannot carry enough blood to the heart muscle, nearby arteries get wider and even open up tiny new branches to deliver blood to the area of muscle that needs it. This is called collateral circulation.



Courtesy American Heart Assoc.

FIGURE 2A FIGURE 2B

Figure 2A shows a cross-section of a normal artery greatly enlarged. Figure 2B shows deposits found in the inner lining.



Courtesy American Heart Assoc.

FIGURE 3A FIGURE 3B

Deposits harden, then a blood clot blocks the narrowed channel.

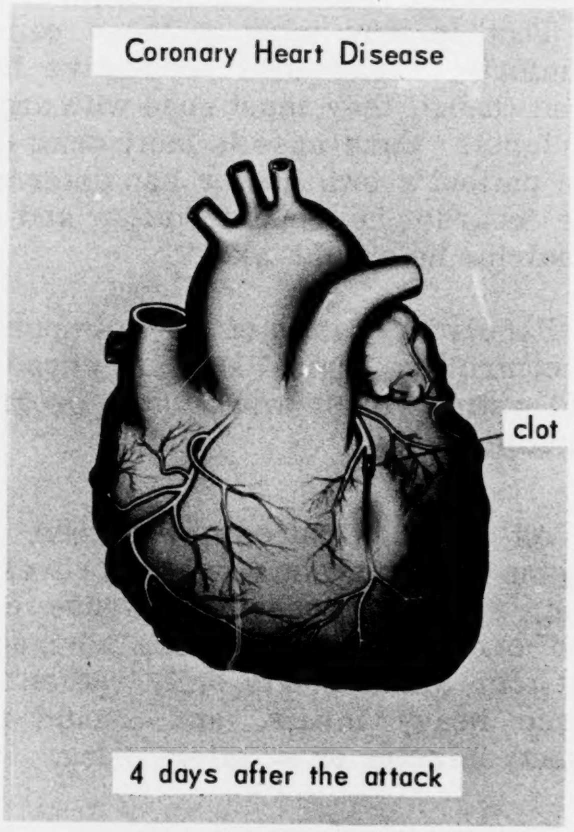
This collateral or substitute circulation often develops while the main coronary arteries are becoming narrowed. This explains why many of us who have narrowed arteries are not troubled with angina pectoris or heart attacks. Once a heart attack occurs, the development of the collateral circulation may help the heart to mend itself.

RECOVERING FROM CORONARY THROMBOSIS

When a clot suddenly shuts off the supply of blood to a part of the heart muscle, the central part of the area deprived of blood may die. The affected area must heal to form strong scar tissue. At the same time, a new blood supply to the area develops by means of the collateral circulation just described. (See Figures 4 and 5.)

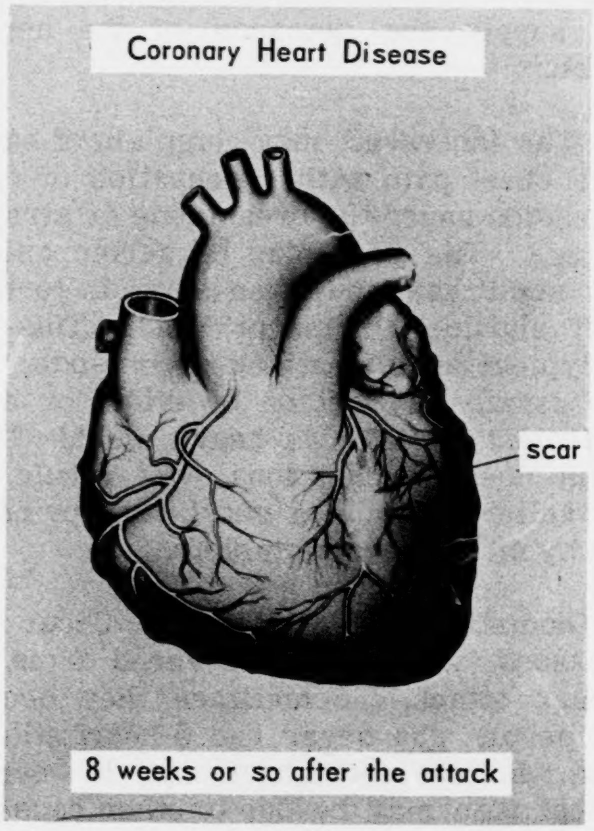
Treatment is aimed at giving the heart time to mend itself. Even though the patient feels well after the first week, he must continue to rest in bed or chair to give the heart time to heal.

The time required for the patient to get back on his feet will depend on the extent of the heart injury, the rate of healing, and whether or not complications develop. Although medicines are helpful, the patient's cooperation and understanding play a large part in his recovery.



Courtesy American Heart Assoc.

FIGURE 4. White cells are clearing away the dead tissue. Scar tissue is beginning to form at the edges of the damaged area (just below the clot). The patient must remain quiet because during the first two weeks or so there is danger that this weak spot will rupture.



Courtesy American Heart Assoc.

FIGURE 5. Tough scar tissue has formed. The patient begins to resume activities. He must keep his weight down, avoid severe mental and physical strain. Moderate physical activity is encouraged.

ANGINA PECTORIS

Angina pectoris is a severe chest pain that signifies that the heart muscle is not getting enough oxygen through its blood supply. It usually means that some of the coronary arteries have become so narrowed by atherosclerosis that they do not let enough blood through to supply the demands of the heart muscle.

The individual may complain of severe chest pain with a sensation of oppression under the breastbone or strangling. The pain may be accompanied by numbness and often spreads to the left shoulder, arm, or hand. This is a typical anginal attack or episode. It is usually brought on by effort or excitement, or after a heavy meal. The pain does not last long. As a rule, it is relieved within a short time by rest or by nitroglycerine tablets.

Sometimes anginal pains occur in persons who have recovered from a heart attack. Sometimes they occur in people who never had a heart attack and who may never have one. However, chest pain may be due to other causes. It should always be reported to a physician.

LIVING WITH ANGINA PECTORIS

The same process of collateral circulation that increases the blood supply to the heart muscle after a heart attack can also come to the aid of the patient with angina pectoris. Given time, some branches of the coronary arteries may enlarge and new branches open to deliver enough blood to the heart muscle to enable the individual to carry on his usual activities.

That is why most persons can be comfortable and lead productive lives even though they must cope with angina pectoris. Each case is individual; only the patient's own doctor can determine the course he should follow and the medicine he should take.

Regulating habits of life is important in controlling anginal attacks. Physician and patient must work out a program together.

As a rule, patients who have had angina pectoris should avoid overexertion, rushing, worrying, intense cold, and overweight. They are advised to eat four small meals daily rather than three heavy meals, and should rest twenty minutes or so after eating.

Certain drugs are helpful, too. The physician almost always prescribes nitroglycerine tablets. The patient is told to let a tablet dissolve under the tongue to relieve the pain of angina. Often, if he expects to be in a difficult or exciting situation, the patient is told to take a tablet beforehand to avoid an attack of anginal pain.

TECHNICAL INSTRUCTIONS FOR SQUADMEN CONCERNING CORONARY ATTACK

THE TISSUES INVOLVED

The blood vessels of the body are made up of three layers: (1) an outer protective layer, (2) a muscular center layer and (3) a smooth inner layer. The center muscular layer is the one which is most highly involved in the coronary heart attack.

BLOOD SUPPLY SHUT OFF

A person who experiences fear or pain becomes very tense; all his muscles tend to tighten. The pain that a victim experiences due to the formation of a clot within the coronary artery, and associated fear, cause the muscular layer of the blood vessels around the clot to clamp down. If this muscular layer does not relax, blood will be unable to pass the affected area. The part of the heart that is involved will die.

It follows then that it is of the greatest importance to do everything possible to help a victim to relax.

SYMPTOMS

The following symptoms will be exhibited by a heart attack victim.

Severe Pain - This pain will be over the front of the chest. It may radiate to the shoulder, arm, and hand. The victim may complain of pain or just a numbness in the above-mentioned parts.

Shortness of Breath - This is a usual symptom for any heart victim. Shortness of breath is due to the diminished supply of blood to the lungs. This is a very dramatic and severe symptom.

Apprehension or Fear - This is due to the pain and the thought of impending death. The face will show fright, and the eyes will be opened wide.

Activity and Restlessness - The victim will continuously try to move about and will try to get up. If he is able to be up, he will pace up and down.

Shock - All of the symptoms of shock may be evident. Actually, some victims are in shock during the entire attack.

Passing Out - This may occur in the beginning or later in the attack. It sometimes is the first sign and will be followed by the other symptoms mentioned.

EMERGENCY CARE

Severe Pain - For heart attack victims, physicians administer medicine which not only relieves pain but which also relaxes the victim as well as the muscle layer of the blood vessel around the clot. Squadmen are not permitted to give medication. However, if the patient is under medical care the squadmen may assist in administering prescribed medicine which is carried by the victim or is in the household. The squadman can alleviate coronary attack pain by carrying out the steps described in the following paragraphs.

Shortness of Breath - The victim should be given oxygen in the highest concentration possible. The coronary victim is often so afraid and desperate that he will fight the squadman who approaches with the mask, since the victim feels that the mask will smother him. Do not fight with the victim. This only causes the victim's fear to become greater, and in turn, his condition more critical.

If the victim will not take oxygen by mask, disconnect the mask from the outlet and hold the outlet under the victim's chin or in front of his nostrils. In this way the victim will be given a high concentration of oxygen which will tend to make him rest more easily.

Apprehension or Fear - The three big words in squadman care at this time are, "Talk to him." Tell him exactly what will be done and why. Understanding what is being done will tend to alleviate his fear and thus make him relax. The result for which one should strive is the relaxation of the muscular layer of the involved coronary artery.

Activity and Restlessness - There are three words to remember in the care of the victim in this condition: "Do for him." Every effort should be made to keep a heart victim from being active or restless. Being active will put additional stress on his heart. The squadman must not allow the victim to move more than is absolutely necessary. The victim must be kept at rest.

Shock - The care of a heart victim under shock is somewhat different than usual. The three important words to remember are (1) heat, (2) position, and (3) fluids.

1. Heat - Conserve body heat by use of a blanket, but do not make the victim too warm. If the victim experiences a smothering effect from the blanket, do not put the blanket further up than is comfortable. Do not fight the victim.

2. Position - The victim should be placed in the most comfortable position possible. Some victims will feel best lying flat, others in a partial or definite sitting position. Do not fight with them. Care for and transport the victim in the most comfortable position possible.

3. Fluids - Give only small amounts of water to sip, or just moisten the victim's lips. If a victim is given too much fluid, it may cause him to vomit. This in turn will place an additional strain on his heart. The water should not be ice water.

Passing Out - If this should occur during care of the victim, keep a careful watch of the victim's air passage. If the victim should stop breathing, apply artificial respiration immediately, unless mechanical respiration equipment is set up ready to be used. If artificial respiration is applied, it should be replaced by mechanical respiration as soon as the equipment can be checked and put in service.

TRANSPORTATION

In the care of coronary victims it has been stressed that everything possible should be done to make the victim comfortable and to keep him at rest. Transportation of a victim should be carried out at a moderate speed with no siren. It is obvious that a fast trip to the hospital with a blaring siren would not contribute to the well-being of the victim, since it would probably cause him additional fear. The use of oxygen during transportation of heart victims is often very desirable, since it makes breathing easier.

CHRONIC HEART FAILURE

CAUSES

Chronic heart failure is usually due to old age or to a former heart condition that has weakened the heart. Actually, the condition is a weak heart.

The heart is unable to do its usual work. With the lessened supply of blood and poor blood pressure, the victim will have the following symptoms:

1. Wet respiration (noisy)
2. Swollen feet and hands caused by fluid in the tissues
3. Continuous fatigue

The swollen feet and hands are due to the poor circulation. The waste products or materials given off by the body are not carried away from the feet and hands, since the blood pressure from the weakened heart is too poor to push these waste products back up to the heart. These products are then pooled in the tissues of the feet and hands.

With the continual pooling of this waste material, the circulation is further impaired and causes more strain on the heart. The heart tries to pump faster and harder and, then, actually tires out or fails.

SYMPTOMS

Severe Fatigue - The victim may hardly be able to move around. He may be scarcely able to talk. He may look like a person who has just run a long distance.

Shortness of Breath - The shortness of breath is due to congestion in and poor circulation to the lungs by the heart in failure. Since it does not pump enough blood to the lungs, enough oxygen is not supplied to the body. Therefore, the body has a constant need for adequate oxygen. The victim will have long inspirations and long expirations. They will be slow at times and fast at other times. The victim will also have "noisy" respirations due to the poor circulation and congestion in the lungs.

Swelling of Hands, Ankles, and Feet - This swelling is due to the accumulation of the body waste products in the tissues.

Shock - The victim will be in a condition of shock during the attack; he will exhibit extreme perspiration.

EMERGENCY CARE

Severe Fatigue - Since any activity on the part of the victim will cause the attack to become worse, the squadman should attempt to anticipate the victim's every need so that it will be unnecessary for the victim to move.

Shortness of Breath - Oxygen should be used. This type of victim will exhibit oxygen hunger rather than fear or avoidance of it.

Noisy Respiration - This condition can be overcome somewhat by the squadman using the following procedure if the inhalator in service contains a breathing bag.

1. When giving the victim oxygen, let the inhalator bag fill to its capacity.

2. On the next inspiration, squeeze the inhalator bag, keeping the face piece snug to the victim's face.

3. Keep up this procedure, if possible, until the victim is under medical care.

This practice will cause the oxygen to push the excess fluid in the air sacs of the lungs back into the circulating blood. If the inhalator does not contain a breathing bag, it will be impossible to carry out the procedure.

Shock - The usual shock care must be varied for this particular condition.

1. Heat - Because of the usual old age of the victim, do not chill him. Cover the victim and conserve body heat. Do not over-heat him.

2. Position - The victim will want to stay in a position in which his chest is elevated, or in an actual sitting position. Do not force him to lie down; the fluid in his lungs can cause him to drown.

The chronic heart failure victim usually has lived with his condition for years. He may even sleep in a chair, so that his chest will be elevated at all times.

3. Fluids - Give only small amounts of water. The victim will usually want his lips moistened.

After the victim is prepared for transportation, try to keep him comfortable at all times. If his head and chest must be lowered for a short time to carry out transportation, explain this before doing it.

STROKE

(CEREBROVASCULAR ACCIDENT)

DEFINITION

A stroke is a sudden paralysis with total or partial loss of consciousness due to a part of the brain being deprived of its blood supply.

CAUSE

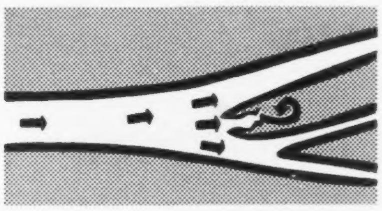
Many times it is difficult to determine the cause or causes of a particular stroke until extensive medical examinations are made. However, the usual causes are hemorrhage, clotting, or compression of one or more of the blood vessels in the brain.

The most frequent cause of stroke is a cerebral hemorrhage. As a result of atherosclerosis and high blood pressure, the artery wall may burst and flood the delicate brain tissue with blood. Not only does his hemorrhage deprive a portion of the brain with food and oxygen, it also forms clots that displace and damage surrounding brain tissue. (See Figure 6.)

Bleeding of an artery in the brain may also be caused by a head injury or a weak spot in the artery wall.

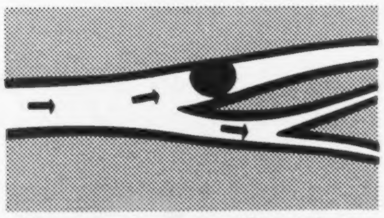
Another cause of stroke is the blocking of a cerebral artery by a clot (called a thrombus) that forms inside the artery. This condition is known as cerebral thrombosis (See Figure 7).

A clot is not likely to occur in a healthy artery, but due to hardening or thickening, deposits form on the inner lining of the artery. This condition is known as atherosclerosis and is responsible for triggering the clotting mechanism.



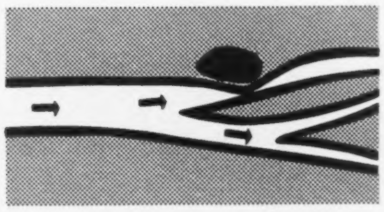
Courtesy American Heart Assoc.

FIGURE 6. Hemorrhage



Courtesy American Heart Assoc.

FIGURE 7. Clotting



Courtesy American Heart Assoc.

FIGURE 8. Compression

Sometimes a traveling clot, called an embolus, is carried in the blood stream and becomes lodged in one of the arteries in the brain. This is called a cerebral embolism, and it also interferes with the flow of blood to the brain.

A stroke may also be caused by pressure on the brain or its blood vessels. When hemorrhage occurs, the escaping blood may clot and form a solid mass that presses against a nearby artery, or a tumor, an abnormal growth of tissue, may compress an artery or the surrounding brain tissue. (See Figure 8.)

SIGNS AND SYMPTOMS

The onset of a stroke is usually sudden. The victim may collapse and later lapse into unconsciousness. There may be a feeling of numbness in an extremity progressing to paralysis. The face and mouth may pull to one side and the pupils of the eyes are often of unequal size. If conscious, the victim may exhibit mental confusion; the inability to concentrate; slurred speech, and signs of nausea and vomiting. Remember that the symptoms will vary with the extent of brain damage, but in the majority of stroke victims that the squadmen see, the usual signs and symptoms will be quite evident.

EMERGENCY CARE

1. Elevate the victim's head and shoulders slightly.

2. Apply cold compresses to the victim's head.

3. Do not move the victim any more than is necessary.

4. Do not give anything by mouth, and definitely no stimulants.

5. If the victim vomits, roll him on his side to facilitate the flow of vomitus. Keep air passage clear.

6. Administer oxygen by inhalation. If the victim stops breathing, begin resuscitation immediately.

7. Shield the victim from the curious onlookers.

8. Transport the victim carefully, avoiding all unnecessary movement that may aggravate his condition.

DIABETIC REACTIONS

(DIABETIC COMA AND INSULIN SHOCK)

DEFINITION AND CAUSE OF DIABETES

The basic cause of diabetes has not yet been found, but it is related to the working of the pancreas. This is a large gland lying behind the stomach; juices secreted by it help digest our food. Animal pancreas, sold for food, is known as sweetbread.

One of the hormones made by the pancreas is insulin. This is produced by the so-called isles of Langerhans--groups of cells scattered through the pancreas like islands. The word insulin comes from the Latin for island.

Insulin's principal job is to help the body use glucose. Diabetes may develop because the body loses its ability to burn sugar, or it may develop because the body is making too much sugar.

Whichever of these possible causes is the actual one, it can be traced to a lack of insulin. We know this because when a diabetic is given the right amount of insulin by injection, the sugar in his blood drops to a normal amount and none is carried off through the urine. (See Figure 9.)

Due to a neglected diet, failure to take insulin, or other reasons, the diabetic can go into either of two conditions: diabetic coma or insulin shock.

DIABETIC COMA

This condition is caused by the incomplete oxidation of fatty acids, which produces acetone bodies and is common in uncontrolled diabetes.

Clothing of any person in a coma should be checked for a medic alert emblem or a card which states that he is a diabetic. Relatives or friends may volunteer the information.

SIGNS OR SYMPTOMS

1. The victim can be confused and unable to cooperate.

2. Nausea and vomiting may be present.

3. The breathing is characterized by very deep, yet not labored, respiratory movements. There is no evidence of obstruction of the air passages or any blueness.

4. The skin is dry and cold.

5. The breath has a sweetish or fruity odor which is acetone.

EMERGENCY CARE

Since this victim needs insulin and the squadmen are not permitted to administer it, transport him to a hospital immediately. He requires careful, expert, and immediate attention from a physician.

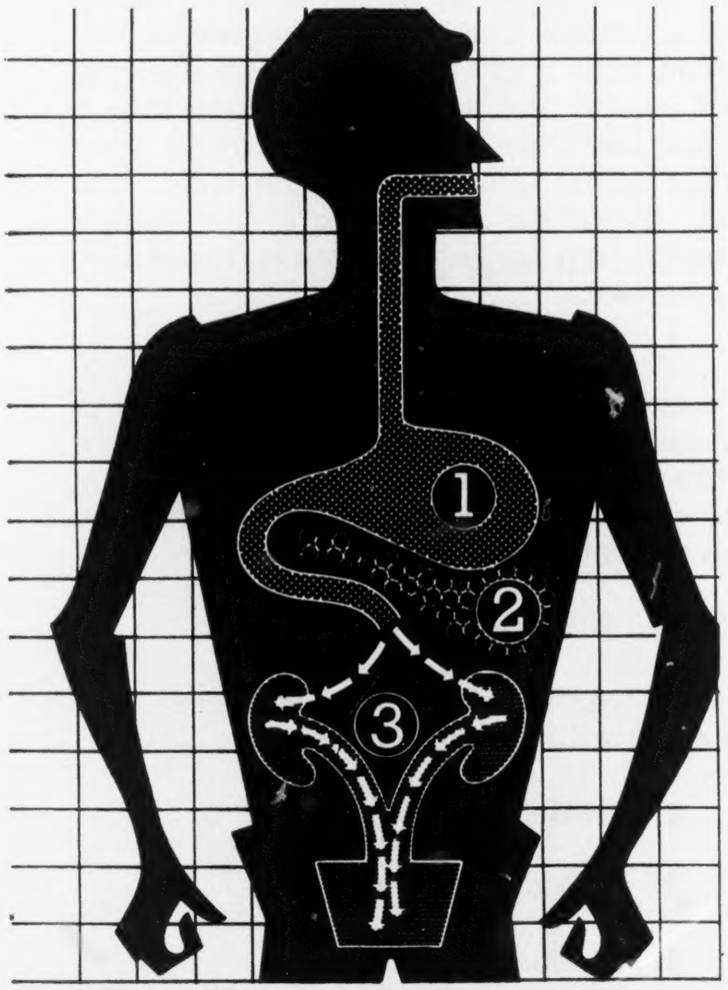
INSULIN SHOCK

Insulin shock is likely to occur in a diabetic when, for any reason, the blood sugar falls. It results usually from the omission of a meal or the vomiting of a meal after taking insulin. Some attacks follow undue exertion. The majority of attacks occur in the morning and in the early evening. An individual whose store

① **The body cannot make use of some foods–mainly sugars and starches (carbohydrates) which enter the blood in the form of glucose.**

② **This happens because there is a decrease in the amount or effectiveness of the insulin produced by the pancreas.**

③ **The glucose (a form of sugar) accumulates in the blood until the surplus passes through the kidneys into the urine.**



TOO MUCH SUGAR IN THE BLOOD AND SUGAR IN THE URINE ARE SIGNS OF DIABETES

Courtesy American Diabetic Assoc.

FIGURE 9. What is diabetes?

of blood sugar is depleted as a result of emotional excitement, exertion or exposure to cold has an increased sugar tolerance and reacts to insulin with a comparatively greater blood-sugar drop than would otherwise be the case. He is, therefore, a candidate for insulin shock; that is, he is temporarily insulin-sensitive.

These reactions begin in five to twenty minutes following an injection of regular insulin, but not for several hours after other types are given. The symptoms and signs should be familiar to every squadman.

SIGNS OR SYMPTOMS

1. General muscular weakness, together with mental confusion.
2. Restlessness.
3. Profuse sweating.
4. Dizziness.
5. Pallor or flushing of the face.
6. Trembling.
7. Hunger pangs in the upper stomach.

The victim may lapse into a coma. Some victim's blood sugar lowers so rapidly that the symptoms progress almost without warning to those of epileptiform convulsions.

EMERGENCY CARE

When the warning symptoms appear, the victim should be given a drink containing sugar or consume a piece of candy at once. Most persons taking insulin carry sugar in some form in their pockets. Taking sugar checks the reaction within a few minutes. If the sudden attack progresses to convulsions, care for the victim as you would any convulsing person.

If untreated, a reaction may result in extensive brain damage and possible death. These people should be transported as soon as possible to a hospital.

CRITICAL QUESTIONS

Two questions that can be asked of the diabetic to determine which state he might be entering are as follows:

1. Have you eaten today?
2. Have you taken your insulin today?

If the person has taken his insulin and has not eaten, he is going into insulin shock. If he has eaten and has not taken his insulin, he is entering diabetic coma. These two questions should be memorized and be ready for use at any time by the squadman.

ADDITIONAL EMERGENCY CARE

Today diabetic coma is fairly rare, but it does occur when a severely diabetic person neglects his diet or fails to take insulin. Occasionally it is confused with insulin shock. Remember, the two conditions spring from opposite causes, and the two conditions need entirely different treatment. Figure 10 lists the ways to tell them apart.

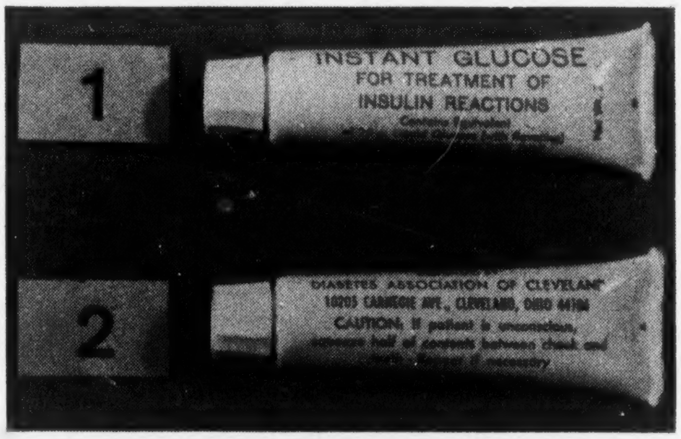
In some cases, the squadman may be certain that the victim is a diabetic, but may be uncertain as to the existing reaction. If the squadman has any doubt as to whether the victim is going into a diabetic coma or insulin shock, he should administer a high sugar solution. This can be referred to as the lesser of two evils, for if the victim is going into insulin shock and sugar is not given, his blood sugar may drop so low that it will cause brain damage.

	INSULIN SHOCK	DIABETIC COMA
Onset	sudden	gradual
Skin	pale, moist	flushed, dry
Behavior	excited	drowsy
Breath	normal	fruity odor (acetone)
Breathing	normal to rapid, shallow	deep, labored
Vomiting	absent	present
Tongue	moist	dry
Hunger	present	absent
Thirst	absent	present
Sugar in urine	absent or slight	large amounts

FIGURE 10

On the other hand, if the victim is going into a diabetic coma, the administration of a high sugar solution will definitely raise the blood sugar level. This can be corrected when the victim reaches definitive care whereas brain damage from an extreme low blood sugar cannot be corrected.

NOTE: Tubes of "Instant Glucose" are available from some local diabetes associations. The contents, a jelly-like substance, according to the local Diabetes Association, can be administered to the conscious or the unconscious victim. This instant glucose should be carried by all squads. (See Figure 11.)



(1) Information on front of tube
(2) Additional information on the back of tube

FIGURE 11. Instant glucose for insulin reaction

POISONS

DEFINITION

A poison is any substance which, when taken into the body or brought in contact with the body's surface, changes the function and structure to such a degree that it will affect health or threaten life.

ENTRANCE OF POISONS INTO THE BODY

Poisons may enter the body by many routes. The most common route is by mouth, whether swallowed intentionally or accidentally; inhaled in the form of toxic gases or dusts; injected within the skin by bites of poisonous snakes, insects, rabid animals or by hypodermic injections; contact with the skin by poisonous plants or absorbed through the skin from poisonous liquids such as insecticides and herbicides.

Upon arrival at the scene of poisoning, the squadmen should observe the victim and his surroundings carefully, and should make observations in regard to the following:

1. The presence of burns about the mouth.

2. Discoloration of the gums.

3. Odors of the breath.

4. The presence of vomitus and other discharged matter and its character.

5. Temperature, pulse, and respiration.

6. Size of pupils.

7. Condition of skin.

8. Peculiarities of speech.

Nothing should be destroyed at the scene. Vomitus and other discharged matter should be saved and taken to the hospital for it may contain the poison which cannot otherwise be identified.

CLASSIFICATION AND ACTION OF POISONS

Poisons entering the human body by mouth are divided into three general classifications; corrosive, irritant, and neurotoxic substances.

CORROSIVE SUBSTANCES

Corrosive poisons burn or eat into the tissues of the lips, mouth, throat, and stomach. Besides the immediate corroding action on the tissues they touch, they cause an inflammed condition of the deeper tissues and in many cases through absorption exert harmful effects on the entire system.

The more common corrosive poisons are acids and alkalies.

Acids

Hydrochloric Acid (metal and masonry cleaners)

Sulfuric Acid (automobile batteries)

Nitric Acid (solutions used in industrial cleaners)

Oxalic Acid (cleaning solutions)

Carbolic Acid (disinfectants)

Alkalies

Caustic Soda (used in soapmaking)

Lime (construction sites and industry)

Potash (drain cleaners, lye)

Ammonia (household cleaners and industrial uses)

SYMPTOMS

The lips and mouth are stained and show signs of searing or burning.

The conscious victim will complain of severe pain in the mouth, throat, and stomach.

Usually intense thirst.

Difficulty in talking or swallowing due to swelling of the mucous membranes.

Shock will be evident.

IRRITANT SUBSTANCES

The irritant poisons when swallowed set up an irritation within the stomach, which is indicated by nausea, vomiting, and severe pain. This type of poisoning is characteristic of a variety of compounds. Many irritants are found in combination with other substances used in many households. The more common irritants are:

Arsenic (found in rat poisons; weed killers)

Copper (plant sprays; rat poisons)

Iodine (once a popular antiseptic)

Lead (paints and dyes)

Mercury (germicides; insecticides, and pyrotechnics)

Phosphorus (matches, rodenticides)

Silver Nitrate (cleaning compounds and inks)

Zinc (weed killers, soldering compounds)

SYMPTOMS

The lips and mouth may be stained or discolored or may appear white and shriveled.

A metallic taste in the mouth is a common symptom.

Severe pain in the stomach, followed by nausea and vomiting.

Shock is usually present in the more severe cases.

NEUROTOXIC SUBSTANCES

These are poisons that primarily affect the nervous system. The neurotoxic poisons are divided into two general groups: (1) depressants, whose general action is that of "sleep-producing," with progressive lowering of the vital functions of circulation and respiration; and (2) convulsants, that produce spasms or convulsions, with rapid paralysis of the vital body functions.

DEPRESSANT POISONS

The depressants are usually medicines or drugs that are given to relieve pain or induce sleep but, when taken in excess, act as poisons. The more common are opium, morphine, paregoric, and sleeping powders or capsules.

SYMPTOMS

The usual symptoms are weariness, drowsiness, and progressive loss of sensibility ranging to a deep coma.

The face will be either pale or blue (cyanotic) and the skin is cold.

The pupils of the eyes are contracted to pinpoint size and do not react to light (especially opium derivative drugs).

The pulse is at first strong and slow but later becomes rapid and weak.

Respiration is shallow and irregular.

CONVULSANT POISONS

The more common convulsant poisons are: the cyanides, belladonna, strychnine, and nitroglycerin. Each of these substances produce a variety of different symptoms.

THE CYANIDES – SYMPTOMS

The symptoms of cyanide poisoning progress very rapidly.

The breath may have an odor of bitter almonds.

There will be giddiness, nausea and vomiting, decreased sensibility, panting respiration, cyanosis, convulsions with extended expiration leading to complete respiratory failure.

BELLADONNA – SYMPTOMS

The skin becomes hot, dry and flushed.

The mouth and throat are dry and swallowing and talking is difficult.

The pupils are dilated.

The pulse is rapid and weak.

The victim will be having hallucinations and if able will be complaining of double vision.

STRYCHNINE – SYMPTOMS

The symptoms of strychnine poisoning progress very rapidly.

There is a feeling of suffocation, the face becomes blue (cyanotic), the neck becomes rigid and convulsions occur in which the body of the victim arches upward so that it rests on the back of the head and on the heels, and respiration ceases.

Convulsions are due to an increased reflex action and are caused by any slight stimulus, such as a gust of wind, a flash of light or the touch of a blanket.

The victim suffers severe pain and is usually conscious until death occurs.

NITROGLYCERIN – SYMPTOMS

Nitroglycerin poisoning frequently occurs among men who handle explosives. Those who are highly susceptible should not handle or expose themselves to explosives containing nitroglycerin.

An overdose of nitroglycerin tablets used by people for the control of anginal pains can cause most serious effects.

The symptoms consist of a throbbing headache beginning in the front of the head and extending to the back of the head and neck with increasing severity. There is an irregular pulse, dilation of the pupils, pain in the chest, muscular weakness, nausea and vomiting, unconsciousness, and convulsions in extreme cases.

EMERGENCY TREATMENT OF POISONING

To treat ingested poisons (those taken by mouth), three general methods are recommended: dilute the poison, induce vomiting, and give activated charcoal (powdered, in water).

Never induce vomiting in poisoning by acids, alkalies, petroleum, or other volatile liquids.

Antidotes for specific poisons can be given if they are readily available, but do not waste time looking for the ingredients to prepare an antidote.

It has been proven that, in the majority of instances, the time spent concocting an antidote would be sufficient to deliver the victim to definitive care.

Having the victim drink large amounts of water provides necessary emergency dilution. For acids and alkalies, dilution with milk, if readily available, is effective. However, do not overload the victim's stomach for this may cause him to vomit.

To induce vomiting, give the victim one or two teaspoonfuls of Syrup of Ipecac. This will usually cause vomiting very rapidly. Vomiting can also be induced by inserting a finger into the back of the victim's mouth. If fingers are used, be extremely careful for severe bites may occur. To avoid bites, push the victim's skin in between his teeth as you are inserting your finger in the mouth.

The use of powdered activated charcoal mixed in water will absorb the poison matter in the stomach.

Inhaled poisons affect the respiratory system and necessary resuscitative procedures must be instituted. The squadmen must wear protective breathing equipment when entering a contaminated area.

For contact poisons, such as chemicals on the skin's surface, the victim's clothing must be removed and the skin must be flushed with large amounts of water. Flush generously during the removal of clothing and after. If the substances have entered the victim's eyes, it may be necessary to hold the eyelids open and flush. Do not use high pressure flushing into the eyes.

Injected poisons causing respiratory problems must be treated by administering the necessary resuscitative measures.

SUMMARY OF EMERGENCY CARE FOR POISONING

1. Notify the hospital prior to arrival, giving the following information:

   (a) Name of poison (if known)

   (b) Quantity taken (if known)

   (c) Victim's age and weight

2. Take poison container to hospital.

3. No fluids by mouth if the victim is unconscious.

4. Know the phone number and location of your nearest "Poison Control Center." These are located in most urban areas.

5. Treat for shock.

6. Administer oxygen.

For information on specific poisons, see Figure 12 on Page 160.

POISONS

Acids · 18
Bichloride of Mercury · 12
Camphor · 1
Carbon Monoxide · 16
Chlorine Bleach · 8
Disinfectant
  with chlorine · **8**
  with carbolic acid · **6**
Food Poisoning · 11
Furniture Polish · 17
Gasoline, Kerosene · 17
Household Ammonia · 10
Insect & Rat Poisons
  with arsenic · **2**
  with sodium fluoride · **14**
  with phosphorus · **5**
  with DDT · **11**
  with strychnine · **15**
Iodine Tincture · 4
Lye · 10
Mushrooms · 11
Oil of Wintergreen · 9
Pine Oil · 17
Rubbing Alcohol · 9
Turpentine · 17
Washing Soda · 10

OVERDOSES

Alcohol · 9
Aspirin · 9
Barbiturates · 3
Belladonna · 15
Bromides · 11
Codeine · 13
Headache & Cold Compounds · 9
Iron Compounds · 7
Morphine, Opium · 13
Paregoric · 13
'Pep' Medicines · 2
Sleeping Medicines · 3

DO THIS FIRST

- **Send for a doctor — immediately.**
- **Keep the patient warm.**
- **Determine if patient has taken**
  (1) A POISON
  (2) AN OVERDOSE
- **While waiting for physician, give appropriate counterdose below.**
- **But do not force any liquids on the patient — if he is unconscious.**
- **And do not induce vomiting if patient is having convulsions.**

To Find the Correct Counterdose

- **In one of the lists printed at left, find substance causing the trouble.**
- **Next to that substance is a number. This refers to counterdose bearing same number in the section below.**

Keep all poisons and medicines out of reach of children

1 Induce vomiting with an emetic such as • Finger in throat, or • Tablespoon of mustard in half glass of water, or • Syrup of ipecac, or • Salt & warm water.	**2** • Give "universal antidote" (obtain from drug store and keep on hand at home) • Induce vomiting. (See #1)	**3** • Induce vomiting. (See #1) • Give 2 tablespoons epsom salt in 2 glasses of water. • Then give large quantities of hot coffee or strong tea (instant or regular).
4 • Give 2 ozs thick starch paste. Mix cornstarch (or flour) with water. • Then give 2 ozs salt in quart of warm water. Drink until vomit fluid is clear. • Finally, give glass of milk.	**5** • Induce vomiting. (See #1) • Then give 4 oz mineral oil. Positively do NOT give vegetable or animal oil. • 4 oz hydrogen peroxide. • 1 tablespoon sodium bicarb in quart of warm water.	**6** • Give glass of milk • whites of two eggs. • Give hot tea or strong coffee.
7 • Induce vomiting. (See #1) • Give 2 teaspoons of sodium bicarb in a glass of warm water.	**8** • Give a glass of milk. • Hot coffee or strong tea plus white of raw egg.	**9** • Give a glass of milk. • Induce vomiting. (See #1) • Tablespoon sodium bicarb in quart of warm water.
10 • Give 2 tablespoons vinegar in 2 glasses of water. • Give white of 2 raw eggs or 2 ounces of olive oil. • Do NOT induce vomiting!	**11** • Induce vomiting. (See #1) • Give 2 tablespoons epsom salt in 2 glasses of water. • Give strong tea or hot coffee.	**12** • Induce vomiting. (See #1) • Then give 2 ounces of castor oil. • Give 1 oz epsom salt in 1 pint of water.
13 • Give glass of milk or universal antidote. • 2 tablespoons epsom salt in 2 glasses of water. • Keep patient awake.	**14** • Give 2 tablespoons of milk of magnesia. • Give glass of milk. • Induce vomiting. (See #1)	**15** • Give glass of milk or universal antidote. (See #2) • Induce vomiting. (See #1) • Give artificial respiration. • Keep patient quiet.
16 • Carry victim into fresh air. • Make patient lie down. • Hot coffee or strong tea.	**17** • Give water or milk. • Give hot coffee or strong tea. • Do NOT induce vomiting.	**18** • Give 1 oz milk of magnesia in large quantity of water. • Do NOT induce vomiting!

FIGURE 12. Counterdoses for common poisons and overdoses.

CONTAGIOUS DISEASES

INTRODUCTION

Many times, after an emergency squad has answered a call, has had direct contact with the victim, and has transported him to the hospital, it is found that the victim is suffering from a contagious disease. Since there are many ways in which contagious diseases are transmitted, it is a must for all squadmen to take special care, not only of their person and personal clothing, but also of their equipment, supplies, and vehicles.

PRECAUTIONS

If the squadmen suspect that the victim may have a contagious disease, he must consider the following precautions: immunization of all squadmen, isolation of the victim, and elimination of the agent.

Immunization -- The prudent squadman will maintain active immunization for the range of diseases that are prevalent today. If there are any questions regarding total immunization, contact your physician or the local health director.

NOTE: See Appendix I on Page 327 for a report on tetanus (lockjaw) prophylaxis prepared especially for this textbook by Wesley Furste, M.D., F.A.C.S., Columbus, Ohio.

Isolation -- The victim of a contagious disease and his immediate surroundings can be isolated by covering with sheets, plastic, or similar material. The squadmen should be protected and his coverings may include cloth masks and gowns.

Elimination -- Upon receiving a call for a response to a victim of a contagious disease, the squadmen should take the time to remove all unnecessary equipment from the vehicle, and to use as much disposable equipment as possible. The use of disposable linens on "known runs" is the best method of preventing the spread of disease. The medical requirements for the emergency ambulance recommends that the patient's area be constructed of a material that can be easily cleaned and sanitized.

Additional precautions that can be taken for specific diseases are listed in Table 1, on Page 162.

COMMON NAME	MEDICAL SYNONYMS	INCUBATION PERIOD	MODE OF TRANSMISSION	CARE OF SQUAD VEHICLE AND LINENS *	CARE OF PERSONNEL **
Diphtheria	Membranous croup	1 to 7 days	Droplet infection and direct contact with cases or with a healthy carrier.	Air car 12 hours. Launder linens.	Schick test. Immunize.
Scarlet fever	Scarlatina	1 to 7 days	Droplet infection, foamites, carriers, pets occasionally.	Air car 12 hours, and scrub. Boil linens.	Dick test. Shower. Change and boil clothes.
Measles	Rubeola or Red measles	7 to 18 days; usually 9 to 11 days	Secretions from respiratory tract and eyes. droplet infection.	Air car 12 hours. Launder linens.	Wash hands.
German measles	Rubella	5 to 21 days	Direct contact, droplet infection from nose and mouth.	Air car 12 hours. Launder linens.	Wash hands.
Whooping cough	Pertussis	2 weeks	Droplet infection, carriers.	Air car 12 hours and scrub. Isolate and boil linens.	Shower. Change and boil clothes.
Mumps	Parotitis epidemic	12 to 24 days; usually 16 to 18 days	Direct contact, droplet infection from nose and mouth.	Air car 12 hours. Air and change linens.	Wash hands.
Chicken pox	Varicella	10 to 20 days; usually 14 days	Droplet infection from nose and mouth; direct or indirect contact.	Air car 12 hours and scrub. Boil linens.	Shower. Change clothes.
Smallpox	Variola	3 to 18 days; usually 10 to 12 days	Direct or indirect contact.	Scrub car. Burn linens.	Burn clothes. Re-vaccinate all exposed persons immediately.
Spinal meningitis or Cerebro-spinal fever	Meningococcus meningitis	3 to 7 days	Droplet infection from nose and mouth of patients or carriers.	Air car 12 hours. Launder clothes.	Shower. See M.D. for possible medication.
Typhoid fever	Enteric fever	10 to 15 days	Fecal contamination of food, water, or milk.	Air car 12 hours. Boil linens if contaminated with urine or feces.	Wash hands and face.
Tuberculosis	Koch's disease or TB	Varies	Infected sputum.	Use sputum cups and burn. Scrub car. Boil clothes and linens.	Avoid close facial contacts.
Syphilis	Lues VD	3 weeks	Usually sexual contact.	Air and launder linens. (No special car care.)	Wash hands. If scratched call M.D.
Infantile paralysis	Poliomyelitis	7 to 14 days	Uncertain: possibly nose and throat.	Air car 12 hours. Launder linens. Wash equipment with soap and warm water.	Shower. Change clothes.
Hepatitis	Serum hepatitis or Infectious hepatitis	10 to 14 days	Infected blood.	Air car 12 hours. Boil linens if contaminated with blood or feces.	Wash hands.

* When a car is being "aired," it is not to be in service. To "scrub car" means to wash the entire inside of the squad car with soap and water.

** In all of these conditions, except syphilis, the squadmen should use cloth, contagious-disease masks.

TABLE 1. Handling of Contagious Diseases

EMPHYSEMA

Emphysema is a non-contagious condition that causes a breakdown or destruction of the lung tissues. This results in the tissues losing their elasticity and respiration is progressively impaired.

SYMPTOMS

Emphysema is the result of a slow, but progressive, breakdown of lung tissue. The victim in advanced stages will suffer shortness of breath with even the slightest physical exertion. This may be accompanied with attacks of coughing, wheezing, dizziness and general weakness.

EMERGENCY CARE

Much has been discussed, pro and con, in regard to the proper emergency care of emphysema, and especially in the administration of oxygen to this victim. The following general procedures will assist the squadman in the care of this victim.

Upon arrival at the scene, the squadman will follow the procedures in making a proper examination. This will include the asking of questions pertaining to the victim's medical history. If the information received indicates that the victim is suffering from emphysema, the squad will follow the procedures that have been established by the victim's physician. However, the majority of runs will only exhibit a victim that is suffering from a respiratory problem; and no one present having any knowledge of a possible emphysema condition.

The usual care for difficult breathing will be administered; maintain an open airway, support with oxygen, place the victim in a position of comfort (usually a sitting or semi-sitting position), and transport to a medical facility.

It is very important that once oxygen administration is started for this victim that it not be stopped until he is in the hospital and under the care of a physician.

In summary the squadmen must maintain an open airway in all victims in respiratory distress. If there is any question about the need for oxygen, it should be given, and should be maintained until the victim is at the hospital where proper evaluation of the blood-gases can be made.

ASTHMA

CAUSE

Asthma is a condition that is caused by either an infection or an allergy that effects the pulmonary system. The bronchi, which are the small tubes that carry air into the lung tissue, are in spasm. This spasm causes the tubes to constrict making respiration very difficult. Usually the asthmatic victim has no problem getting air into his lungs, but there is great difficulty getting the air out.

SYMPTOMS

An acute asthmatic attack is a frightening experience. The victim will be very apprehensive, his eyes will be bulging, and the veins in his neck will be distended. He may have a persistent cough, and be wheezing especially during expiration. The victim will be in need of air due to his difficulty in breathing.

EMERGENCY CARE

Reassure the victim and make him as comfortable as possible. Breathing is easier in the sitting or semi-sitting position; ask the victim which position is best for him. If he is taking a medication, and it is on his person or in the home, you can assist him in taking the medicine, but first read the instructions on the label. Administer oxygen by inhalation, and observe the victim constantly. Maintain emergency care during transport.

EPILEPSY AND CONVULSIONS

DEFINITION AND CAUSE

Epilepsy is a disorder of the brain which causes periodic convulsions. Epileptic convulsions, many times referred to as epileptic seizures, are caused by excessive irritation or sensitivity of certain areas of the brain. Actual causes of epilepsy are unknown, however, there may be many different underlying conditions.

SYMPTOMS

Epileptic seizures may range from a very brief attack, lasting 1 to 30 seconds with no convulsions and no evident loss of consciousness (called a petit mal), to very severe seizures which are characterized by violent convulsions (called a grand mal). The squad is usually called for the grand mal type of seizure and not the petit mal.

Many victims having a warning (aura) that an attack is coming on. They may utter a hoarse cry, the eyes roll upward, and the victim falls forcibily, often injuring himself as he falls. His lips, tongue, and ear lobes may turn blue (cyanotic) due to impaired respiration; he may bite his tongue and grind his teeth. Twitching may begin in one portion of the body, and progressively extend to the entire body, throwing it into convulsions. Involuntary bladder and bowel movements may also occur. After a period of time, the victim may lapse into total unconsciousness and the seizures will stop. On regaining consciousness, he may complain of a headache and may appear confused. Many epileptic victims at this point suffer total embarrassment, especially if the seizure occured in a public place.

EMERGENCY CARE

One of the first steps to be taken is to prevent the victim from injuring himself. Place a padded tongue blade between the upper and lower teeth (the molars on the side of the mouth) to prevent the victim from biting his tongue. It is difficult to place the tongue blade during a seizure, but it can be inserted during the relaxed state between seizures.

The head of the epileptic should be protected at all times. This can be accomplished by placing some soft material (pillow, blanket roll, etc.) under his head. The clothing around his neck and chest should be loosened. His convulsive motions should be guided and controlled to prevent him from further injury, but the epileptic victim should not be forcibly restrained during the periods of convulsion.

Respiration is usually impaired due to the diaphragm being involved in the seizure. This is not usually a problem for the victim will start breathing and "pink-up" after the attacks and between seizures.

The duration of the convulsion and the general reaction following it should be observed and included in the notes for the emergency room personnel. This information should include the length (in time) of the seizure, time interval between seizures if more than one, the parts of the body involved, and any other observation that may have a bearing on the seizure.

CONVULSIONS IN CHILDREN

DEFINITION

A convulsion is a loss of consciousness with a generalized twitching of the muscles.

CAUSES

General convulsions in children have various causes.

In very young infants (two to four months) convulsions may be due to birth injuries. In older infants and young children a convulsion may mark the onset of an infectious disease, epilepsy, drug poisoning, or a nutritional disease. The cause may be unknown.

In children that the squadman will see, the usual cause of a convulsion is a high fever. (This is true 95% of the time.) This can be determined by just the touch of your hand on the child's skin.

EMERGENCY CARE

If a high fever is the cause of the convulsion, the cause must be eliminated.

The child's temperature must be lowered.

This can be accomplished by sponging the child's body with cold applications. The solution used should be tap water, not ice water.

The proper way to "sponge" or cool a child's body is:

1. Obtain two large bath towels.

2. Fill a basin with cold tap water.

3. Take off all of the child's clothing.

4. Submerge towel in cold water and apply completely open, on one side of the child's body. (Front or back of the child).

5. Pat the towel; do not rub it. When the towel becomes warm, remove it and place a cold one under the child.

6. Repeat this procedure during transportation to a hospital or until a physician arrives.

7. An airway should be inserted to keep the victim's tongue forward. This will maintain a good exchange of air, but watch for a gag reflex.

Remember to cool only one side of the body at a time. An ice bag can be placed on the child's head if desired. Also some physicians recommend the addition of an ounce of 70% alcohol (rubbing alcohol) to the water. Add this only on a physician's order.

The squadman should start this entire procedure as soon as possible and continue it until the convulsion stops or a physician arrives. He will probably recommend that this work be continued.

These children should be in the hands of medical personnel before the squadmen leave them.

CHAPTER XVI

THE MENTALLY DISTURBED

Many mildly disturbed persons are about us daily. It is only when their actions are especially unusual that attention is brought to them.

On many occasions the emergency squad is called to attend someone who is behaving oddly. It is paramount that the squadman remember he is to assist disturbed people and not judge or punish them.

This chapter will be divided into two sections. One describes the care of victims who are emotionally disturbed because of disasters and accidents. The other describes victim care for the more usual emotional disturbances that the squad might see.

CARE OF EMOTIONALLY DISTURBED PEOPLE IN LARGE-SCALE EMERGENCIES

The American Psychiatric Association has divided the reactions to large-scale emergencies into 5 categories: (1) normal reaction, (2) individual panic or blind flight, (3) depressed reaction, (4) overly active response, and (5) bodily reaction. Each squadman must understand these individual reactions to an emergency and how to cope with them.

NORMAL REACTION

Symptoms - The experienced squadman has often seen this reaction to emergencies. In fact, a squadman himself may have a normal reaction to an emergency. The signs of this reaction are trembling, profuse perspiration, nausea, and weakness. A victim may be confused. He may experience what is somtimes called "temporary state of shock."

Emergency Care - Reassure these people. If you encourage them often, they usually will recover in a short time. They then may be able to assist the squadmen, in the case of a large-scale emergency.

BLIND FLIGHT OR INDIVIDUAL PANIC

Some laymen describe this disturbance as "running wild."

Orderly Exit - It is not thought to be panic if a person or group remove themselves in an orderly way from a dangerous or supposedly dangerous situation. A good example of proper control of panic is fire-drill practice in schools. If children did not practice orderly exits, many might panic in a real emergency, causing the whole class or school to panic. But because of practice drills there is a quick, orderly, normal reaction.

Symptoms - There are a variety of symptoms of individual panic. The victim may attempt to flee from the scene. Squadmen have found uninjured persons running about a scene or away from it. The victim may lose all judgment. He may want to do unreasonable things at the scene which could be done later. He may weep uncontrollably. This sign may come on with little stimulus. For example, at the scene of a home accident someone may be running about wildly and weeping. It may later be found that this victim is not part of the family, but a distant neighbor who happened by and reacted to the injured person in this way.

Emergency Care - Be firm but gentle at first. If the victim is so upset that he might cause other people to panic, he should be isolated. This may require the effort of several people.

A panic-stricken victim sometimes can be isolated in the emergency squad vehicle or a police car. If there are injured persons involved, another squad should be called to take the person suffering from individual panic to the hospital. To put this victim in the same vehicle with severly injured people could increase the shock of the injured.

To bring the person with individual panic under control upon your arrival may have a reassuring or calming effect upon many other people. This will contribute to better patient care for all concerned.

Do not strike the panicky victim, or slap him, or throw cold water on him. These methods have been found to be of little help.

DEPRESSED REACTIONS

Symptoms - In the midst of a bad accident scene or disaster, this victim may behave as though there is no one around him. He seems to be "in another world". This behavior has been witnessed many times at large-scale accidents such as explosions, tornadoes, train and bus accidents, etc.

The accident is more than the victim can take mentally , so he shuts the outside world out. He may have a vacant expression, showing no emotions. He may sit or stand without moving or talking.

Emergency Care - Do not rush this victim of depression. Your contact must be gentle. Try to get the victim to talk. Ask him what happened.

Finding a routine, simple job for him might help to bring him back to normal. He might help you with simple jobs in caring for patients, such as holding a flashlight, bandages, reports, etc. In a short time he may realize that the disaster is not as great as it seemed, or that he is making a positive contribution by helping the squadmen.

Do not tell the victim to "snap out of it." Do not feel resentful toward him or show resentment. Do not pity him verbally.

OVERLY ACTIVE RESPONSE

Symptoms - This person will be exploding with energy and ideas at the scene. He cannot sit or stand still. He will jump from job to job, hardly ever finishing one. He may joke inappropriately, talk very rapidly, and be argumentative.

Upon arrival, the squadmen may at first think this person is being helpful, but in a short time it will be found that his activities are useless.

By insisting on their own ideas and going from one place to another, these acutely active victims may be a cource of opposition to your sound, practiced rescue and emergency procedures.

Emergency Care - Under proper supervision these victims can become somewhat composed.

Do not agree with them. Tell them that the rightness or wrongness of your order can be dealt with later. These persons are the first to find fault with anything, and may be very disturbing to the squad members if not supervised.

Their need for physical activity is very urgent. Find jobs for them that use physical activity.

Give them some personal attention. Talk with them for a short time. If they think they are "on your side", they will be of some help to you.

Do not tell them that they "should not feel the way they do."

BODILY REACTIONS

Symptoms - These reactions are different from the normal reactions described in this section. The symptoms include severe nausea and vomiting. Victims may also lose the ability to move their limbs. Loss of sight, hearing, or speech may also occur. These are forms of conversion hysteria: the victims subconsciously convert their anxiety to a part of their body.

Do not assume that someone who shows symptoms of conversion hysteria is not physically injured, until he has been examined thoroughly.

Emergency Care - If a victim believes that a part of his body is injured, treat it as though it is. A splint or other measures may help temporarily.

Show the victim that you are interested in helping him.

Sometimes having a job will help him to forget his disability, and this may lead to recovery and use of the part.

Do not blame or ridicule the victim. Conversion hysteria is not under conscious control.

Do not tell him that there is nothing the matter with him. A victim can be functionally blind or paralyzed, even though the involved structure is uninjured.

SUMMARY

In dealing with any of the five described kinds of reactions, the squadman must establish an effective contact with the disturbed person. Once this contact is made it is reasonably easy to help him.

A victim may exhibit one reaction, and later another. The squadmen must be able to care for all reactions exhibited.

The following general approaches should produce positive results:

1. Accept every person's right to have his own feelings. People do not always act as we want them to.

2. Accept a casualty's limitations (or reactions) as real.

3. Size up a casualty's potentialities as accurately and as quickly as possible.

4. Accept your own limitations in disaster or accident situations.

COMMON MENTAL DISTURBANCES

There are medical conditions commonly seen by squadmen, pertaining to the mentally disturbed patient, and not necessarily related to an accident. Delirium tremens, hysteria, and amnesia are among the most common.

DELIRIUM TREMENS

Delirium tremens is a mental disorder, involving hallucinations both visual and in hearing, commonly called "D.T.s."

This acute type of insanity may be brought on by (1) a prolonged alcoholic drinking spree or a sudden withdrawal of alcohol, (2) an acute infectious disease, or (3) trauma (injury), especially fractures and severe crushing injuries.

Symptoms - The victim usually experiences depression, uneasiness, and insomnia for a day or two. Then coarse shaking develops along with hallucinations, usually involving nonexistent things "seen".

Emergency Care - Transport the victim to medical as well as psychiatric care at once, so as to protect him and those with whom he may come in contact. He may see or hear things that are not actually present, and may strike out at these imaginary objects or start to run from them. Squadmen should remember this and not assume that the victim is striking at them.

Try to engage the victim in general conversation. While talking with him, get him into the squad vehicle and transport him. If violence is encountered, you may be forced to restrain him for his own protection as well as that of the squadmen.

HYSTERIA

Symptoms - Hysteria is manifested in many ways. It may be as mild as a headache, or so violent that it brings on self-destruction or personal injury.

The causes of hysteria stem usually from nervous disorders or a sudden psychological shock. Persons in a state of hysteria are usually not aware of their actions. The arrival of an emergency vehicle and the squadmen may cause hysteria to become much worse. Because of this, the proper approach to hysterical patients is most important.

Emergency Care - In your speech and movements try to convey a reassuring calmness.

1. Your actions should not be hasty, but deliberate and meaningful.

2. Talk to the victim softly and slowly. All motions should be slow and deliberate.

3. After talking to the hysteria patient in order to win his confidence, arrange to transport him to medical help.

4. Many times, the victim will not consent to ride in a squad car, but will go with members of the family in a private car. If the victim is quiet and acts normally, letting him go with members of the family might be the best move.

5. If the victim is violent upon the squadman's arrival, the squadman must take precautions to prevent harm to himself or the victim. The method of approach described above may be used to get close to the victim. As soon as the squadman is able to grasp the victim, he should do so, but he should first make sure there is plenty of additional help at hand. Some feel it is better to approach the violently ill in numbers from the very beginning.

6. The squadman should try to get these people to medical help quickly.

AMNESIA

Symptoms - The true amnesia victim will act very much like an unconscious person who has been suddenly awakened. The victim may be able to give his name, but he will not remember anything about his past. Some victims will obviously be dazed and will recall neither their names nor their whereabouts. Furthermore, the victim will be slow to move.

The cause of amnesia may be either physical or psychological shock. Usually it is the latter.

Emergency Care - Transport the victim to the nearest medical help. He may need psychological care. A physician will be able to arrange appropriate treatment for him.

TRANSPORT OF THE MENTALLY DISTURBED

The most critical time for the emergency squad in handling a mentally disturbed victim is during transportation. It is then that the squadmen must rely on their own ability and judgment. At the time of pick-up there will be possible help from the family, neighbors, or police. At the hospital, upon delivery of the victim, assistance from the physicians, nurses, or staff may be available. Many potential problems can be overcome if the following are considered: The question of using restraints must be discussed with the family, the victim, or the police before leaving the scene. When transferring a female, someone from the family must accompany the squad. During transport, many times a stranger or a neighbor is a better companion than one of the family, particularly if the mental disorder has been the result of a family problem. Regardless of who it may be, someone must accompany the female mental victim. Many mental problems are the result of brain tumors or brain injury. These individuals may go into convulsions during transit. Treat them as you would an epileptic convulsion. Continually reassure and calm the victim. Encourage him by stating that you are there to help him and you will do all you can to protect him from the people and/or things that he fears.

ALCOHOLISM

Alcholic intoxication is a temporary mental disturbance along with muscular incoordination. Its effect on the central nervous system will vary with the amount of alcohol consumed.

The squadmen must be very careful in their examination of an assumed intoxicated person. Many a man who was suffering from an injury or illness has been arrested for intoxication and placed in jail without medical attention, often with fatal results. Before beginning any treatment for intoxication, be sure that other possible causes of the victim's condition are ruled out.

SYMPTOMS

Alcohol taken in excess acts as a depressant. The victim will have the odor of alcohol on his breath. He is partly or completely unconscious, although usually he can be aroused for brief periods but soon falls back into a stupor. In the early stages his face is moist and flushed, his pulse strong, and his breathing deep. Later his face becomes dry and appears puffed or swollen, with a bluish color, his pulse becomes weak and rapid, and breathing is shallow. His eyes are blood shot and the pupils are normal or dilated, but of equal size. Always carefully examine the eyes of a suspected intoxicated person. If the pupils of the eyes are of unequal size, there is some injury to the brain.

EMERGENCY CARE

If the victim is conscious, every effort should be exerted to induce vomiting. In addition give him a solution of salt water (1 teaspoon of salt to a glass of water) to soothe the inflamed areas of the stomach. Treat him for shock and administer oxygen.

If the victim is unconscious, he should be placed in a prone position (on his stomach) with his head lowered. This will prevent aspiration of vomitus and help maintain an open airway. Treat for shock and administer oxygen.

Transport the victim to the hospital and keep him warm, for pneumonia frequently develops in the alcoholic.

If the victim, upon arousing, becomes unruly, the squadmen must use great tact in dealing with him. Make every effort to gain his confidence. Restraint should be the last resort. Under no circumstances let the victim convince you that he is "all right."

CHAPTER XVII

DRUG ABUSE

INTRODUCTION

The abuse of drugs is not a new problem. For many years, individuals have been trying to ease grief, loneliness, discomfort, and attempting to escape from reality with the aid of drugs. However, in recent years, the misuse of drugs has become a serious matter, and the abuse of drugs can be found in all age groups and social classes.

TYPES OF DRUGS AND THEIR EFFECTS

Previously in this country, drug users belonged to the lower social class, lived in large cities, and the drug most often abused was heroin.

Today, drug dependent individuals can be found everywhere. They use a variety of drugs ranging from the popular marijuana to the highly publicized LSD.

The following information regarding types of drugs and their effects may assist the emergency squadman in recognizing the drug used and taking the necessary action. Remember that the proper law enforcement agency should be notified of all suspected illegal drug use.

NARCOTICS

The term narcotic refers, generally, to opium and pain-killing drugs made from opium, such as heroin, morphine, paregoric, and codeine. These and other opiates are obtained from the juice of the poppy fruit. Several synthetic drugs, such as demerol, and dolophine, are also classed as narcotics. Opiates are widely used in medicine as pain killers. Cocaine, made from coca leaves, and marijuana are classified, legally but not chemically, as narcotic drugs.

Since heroin appears to be the narcotic used by most addicts today, the listed effects will deal mainly with heroin.

PHYSICAL EFFECTS OF NARCOTICS

Typically, the first reaction to heroin is reduction of tension, easing of fears and relief from worry. Feeling "high" may be followed by a period of inactivity bordering on stupor. Heroin, which is usually mixed into a liquid solution and injected into a vein, dulls the edges of reality. Addicts have reported that heroin "makes my troubles roll off my mind," and "it makes me feel more sure of myself."

The drug depresses certain areas of the brain, and may reduce hunger, thirst, and the sex drive. Because addicts do not usually feel hungry, their hospital care may include treatment for malnutrition. The drug may also reduce feelings of pain. Withdrawal symptoms appear in the addicted person about 18 hours after the drug has been discontinued.

In general, effects of the drug are influenced by many factors, including the user's personality, size and frequency of dose, and how the drug was taken.

AMPHETAMINES

Amphetamines, first produced in the 1920's for medical use, are stimulants to the central nervous system and are best known for their ability to combat fatigue and sleepiness. They are also sometimes used to curb appetite in medically supervised weight reduction programs. The most commonly used stimulants are amphetamine (Benzedrine), dextroamphetamine (Dexedrine), and methamphetamine (Methedrine).

Slang terms for these drugs, used by some people who misuse them, include "pep pills," "bennies," and "speed."

PHYSICAL EFFECTS OF AMPHETAMINES

When properly prescribed by a physician, moderate doses can check fatigue, and produce feelings of alertness, self-confidence, and well-being. In some people, this is followed by a letdown feeling, or depression hangover. Heavier doses cause jitteriness, irritability, unclear speech, and tension. People on very large doses of amphetamines appear withdrawn, emotionally dull, and mentally disorganized.

Amphetamines are stimulant drugs that increase the heart rate, raise the blood pressure, cause palpitations (throbbing heart and rapid breathing), dilate the pupils, and cause dry mouth, sweating, headache, diarrhea, and paleness. They also depress the appetite.

The drugs can drive a person to do things beyond his physical endurance, leaving him exhausted. Heavy doses may cause a temporary mental derangement requiring hospitalization. This is usually accompanied by hearing and seeing imaginary things. Abrupt withdrawal of the drug from the heavy abuser can result in a deep and suicidal depression.

Long term heavy users of amphetamines are usually irritable, unstable, and like other heavy drug users, show social, intellectual, and emotional breakdown.

Dangers from unsanitary injections of "speed" (methamphetamine) include serum hepatitis and abscesses. Injections of "speed" cause abnormal heart rates, and may result in mental derangement and long term personality disorders. Unaccustomed high doses may cause death.

BARBITURATES

Sedatives belong to a large family of drugs manufactured for medical purposes to relax the central nervous system. Of these, the best known are the barbiturates, made from barbituric acid, which was first produced in 1846.

Barbiturates range from the short-acting, fast-starting pentobarbital (Nembutal) and secobarbital (Seconal) to the long-acting, slow-starting phenobarbital (Luminal), amobarbital (Amytal) and butabarbital (Butisol). The short-acting preparations are the ones most commonly abused. Slang terms include "barbs" and "goof balls."

PHYSICAL EFFECTS OF BARBITURATES

Doctors prescribe sedatives widely to treat high blood pressure, epilepsy, insomnia; to diagnose and treat mental illness; and to relax patients before and during surgery. Alone or together with other drugs, they are prescribed for many types of illnesses and medical conditions.

Taken in normal, medically supervised doses, barbiturates mildly depress the action of the nerves, skeletal muscles, and the heart muscle. They slow down the heart rate and breathing, and lower the blood pressure.

But in higher doses, the effects resemble alcoholic drunkenness; confusion, slurred speech, and staggering. The ability to think, to concentrate and to work is impaired, and emotional control is weakened. Users may become irritable, angry, and want to fight or assault someone. Finally, they may fall into deep sleep.

Authorities consider the barbiturates highly dangerous when taken without medical advice and prescription. Because these drugs are commonly prescribed by doctors, many people mistakenly consider them safe to use freely and as they choose. They are not. Overdose can cause death.

Barbiturates distort how people see things and slow down their reactions and responses. Their effects cause serious automobile accidents, especially when they are taken with alcohol. Barbiturates tend to heighten the effects of alcohol.

Users may react to the drug more strongly at one time than at another. They may become confused about how many pills they have taken, and die of an accidental overdose. Barbiturates are a leading cause of accidental poison deaths in the United States.

Because they are easily obtained and produce sleep readily, barbiturates are also one of the main methods people choose to commit suicide.

HALLUCINOGENS

A powerful man-made chemical, lysergic acid diethylamide, generally called LSD, was first developed in 1938 from one of the ergot alkaloids. Ergot is a fungus that grows as a rust on rye--a common grain plant. Just how powerful is LSD? A single ounce is enough to provide 300,000 of the average doses.

Legally classed as a hallucinogen--a mind-affecting drug--LSD is noted mainly for producing strong and bizarre mental reactions. Users experience striking distortions in their physical senses-- what and how they see, touch, smell and hear.

Other less known but powerful hallucinogens or psychedelic (mind-manifesting) drugs include peyote, mescaline, psilocybin, DMT and STP.

PHYSICAL EFFECTS OF HALLUCINOGENS

An average dose of LSD, amounting to a speck, has an effect that lasts for about 8 to 10 hours. Users take it in a sugar cube, a cracker, or cookie, or can lick it off a stamp or other object impregnated with the drug. It increases the pulse and heart rate, and causes a rise in blood pressure and temperature, dilates eye pupils, shaking of the hands and feet, cold sweaty palms, a flushed face or paleness, shivering, chills with goose pimples, a wet mouth, irregular breathing, nausea, and loss of appetite.

The drug is not physically addicting as are the narcotics. That is, the body does not develop a physical need for LSD or physical sickness when it is withdrawn.

PSYCHOLOGICAL EFFECTS OF HALLUCINOGENS

People who use LSD say that it has a number of effects. The first effects, they indicate, are likely to be sudden changes in their physical senses. Walls may appear to move, colors seem stronger and more brilliant. Users are likely to "see" unusual patterns unfolding before them. Flat objects seem to stand out in three dimensions. Taste, smell, hearing, and touch seem more acute. One sensory impression may be translated or merged into another; for example, music may appear as a color, and colors may seem to have a taste.

One of the most confusing yet common reactions among users is the feeling of two strong and opposite emotions at the same time--they can feel both happy and sad at once, or depressed and elated, or relaxed and tense. Arms and legs may feel both heavy and light.

Users also report a sensation of losing the normal feeling of boundaries between body and space. This sometimes gives them the notion they can fly or float with ease.

Effects can be different at different times in the same individual. Researchers have found, even in carefully controlled studies, that responses to the drug cannot be predicted. Users refer to "good trips" or "bad trips" to describe their experiences.

Among LSD's other effects on the user is the loss of his sense of time. He doesn't know how much time is passing, but he does remain conscious.

Scientists report that he can reason logically, up to a point, while undergoing the drug's effects. After the drug wears off he usually remembers much of what happened to him. He may, for example, have become fascinated with an object in the room, like a chair or a vase. On larger doses, he may feel mystical, and report a sense of rebirth or new insights. But he is often unable to explain his experience to others. Many medical authorities feel that chronic or continued use of LSD changes values, and impairs the user's powers of concentration and ability to think. A tendency to "drop out" of society may result.

DANGERS OF LSD

Reports from areas where LSD is used without medical supervision warn of these definite dangers:

1. Panic. The user may grow frightened because he cannot stop the drug's action, and he may fear he is losing his mind.

2. Paranoia. He may become increasingly suspicious, feeling that someone is trying to harm him or control his thinking. This feeling generally lasts 72 hours after the drug has worn off.

3. Recurrence. Days, weeks, or even months after the individual has stopped using LSD, the things he saw and felt while on the drug may recur and make him fear he is going insane.

4. Accidental Death. Because the LSD user may feel that he can fly or float, he may try to leap out of a high window or from other heights and fall to his death. Such accidents have been reported. Or he may drive or walk in front of a moving car, thinking he can't be harmed.

MARIJUANA

Marijuana is a drug found in the flowering tops and leaves of the Indian hemp plant, cannabis sativa. The plant grows in mild climates in countries around the world, especially in Mexico, Africa, India, and the Middle East. It also grows in the United States, where the drug is known as pot, tea, grass, weed, Mary Jane, and by other names.

For use as a drug, the leaves and flowers of the plant are dried and crushed or chopped into small pieces. This green product is usually rolled and smoked in short cigarettes or in pipes, or taken in food. The cigarettes are commonly known as reefers, joints, and sticks. The smoke from marijuana is harsh, and smells like burnt rope or dried grasses. Its sweetish odor is easily recognized.

The strength of the drug differs from place to place, depending on where and how it is grown, how it is prepared for use, and how it is stored. The marijuana available in the United States is much weaker than the kind grown in Asia, Africa, or the Near East.

When smoked, marijuana quickly enters the bloodstream, affecting the brain and nervous system. It affects the user's mood and thinking. Its pathway into the brain is not yet understood. Some scientists report that the drug accumulates in the liver. Because it may cause hallucinations when taken in very large doses, it is classed as a mild "hallucinogen." Just how the drug works in the body and how it produces its effects have not yet been discovered by medical science.

PHYSICAL EFFECTS OF MARIJUANA

The long-term physical effects of taking marijuana are not yet known. The kind of research needed to learn the results of chronic use has not yet been done.

The more obvious physical reactions include rapid heart beat, lowering of body temperature, and sometimes reddening of the eyes. Less obvious reactions are change of blood sugar level, appetite stimulation, and body dehydration. Users may become talkative, loud, unsteady or drowsy, and find it hard to coordinate their movements.

The drug's effects on the emotions and senses vary widely, depending on the amount and strength of the marijuana used. The social setting in which it is taken and what the user expects also influence his reaction to the drug.

Usually, when it is smoked, marijuana's effect is felt quickly, in about 15 minutes. Its effects can last from 2 to 4 hours. The range of effects can vary from depression to a feeling of excitement. Some users, however, experience no change of mood at all. Frequently, the sense of time and distance becomes distorted. A minute may seem like an hour. Something near may seem far away.

A person using marijuana finds difficulty making clear-headed decisions. And he finds himself more easily open to other people's suggestions. Doing any task that takes good reflexes and thinking is affected by the drug. Therefore, it is dangerous to drive while under the influence of the drug.

EMERGENCY CARE AND MANAGEMENT

The chart on page 183 lists the usual signs and symptoms of the most frequently abused drugs. The squadman should study this chart and review it periodically to maintain an awareness of this most critical and current social problem.

The usual emergency run involving the drug abuser will present a victim that is (1) mentally disturbed, (2) in convulsions, or (3) having a respiratory problem.

1. Mental reactions stemming from a "bad trip" may range from a condition of panic to those leading to self destruction.

The squadmen should talk to the victim, reassure him and make every effort to put him at ease. Avoid all quick movements, however, and be positive in your approach. A friend of the victim may be helpful in talking him down, for many times the appearance of the squad indicates the presence of the establishment.

If the victim is violent, the squadmen must do all that is necessary to protect themselves and the victim. Approaching a violent victim in numbers and totally restraining him may be the best approach. (Usually police assistance is available.)

2. The drug victim in convulsions will be treated the same as other convulsing victims. Prevent the victim from injuring himself; guide motions, but do not restrain. Insert a padded tongue blade between the victim's teeth and maintain an open airway.

3. Respiration can be a major problem caused by overdoses of either the depressant or stimulant drugs. The victim may be unconscious and progress into a coma. The squadman will treat this victim as described in the chapter on airway maintenance and resuscitation. Maintain an open air-passage, support with oxygen. Continuously observe the victim, if breathing stops, begin resuscitation immediately.

DRUG LAWS

The following sections of the Revised Code of Ohio are included in this text for reference only, and it is by no means complete.

All questions of legal interpretation involved in a particular case should be presented to the city solicitor or county prosecutor.

SEC. 3719.01 DEFINITIONS.

As used in sections 3719.01 to 3719.22, inclusive, of the Revised Code:

(A) "Person" includes any corporation, association, or partnership of one or more individuals.

(B) "Practitioner" means a person who is licensed in this state to prescribe, dispense, and administer narcotic drugs to a patient or to any animal.

(C) "Manufacturer" means a person, other than a pharmacist who compounds narcotic drugs in accordance with a prescription, who by compounding, mixing, cultivating, growing, or other process, produces or prepares narcotic drugs.

(D) "Wholesaler" means a person who, on official written orders but not on prescriptions, supplies narcotic drugs that he himself has neither produced nor prepared.

(E) "Pharmacist" means a person registered with the state board of pharmacy as a compounder and dispenser of drugs.

(F) "Hospital" means an institution for the care and treatment of the sick and injured, certified by the department of health and approved by the state board of pharmacy as proper to be entrusted with the custody of narcotic drugs and the professional use of narcotic drugs under the direction of a practitioner.

(G) "Laboratory" means a laboratory approved by the state board of pharmacy as proper to be entrusted with the custody of narcotic drugs and the use of narcotic drugs for scientific and clinical purposes and for purposes of instruction.

(H) "Sale" includes barter, exchange, or gift, or offer therefor, and each such transaction made by any person, whether as principal proprietor, agent, servant, or employee.

(I) "Coca leaves" includes cocaine and any compound, manufacture, salt, derivative, mixture, or preparation of coca leaves, except derivative of coca leaves, which do not contain cocaine, ecgonine, or substances from which cocaine or ecgonine may be synthesized or made.

(J) "Opium" includes morphine, codeine, and heroin, and any compound, manufacture, salt, derivative, mixture, or preparation of opium.

(K) "Narcotic drugs" means coca leaves, opium, isonipecaine, amidone, isoamidone, keto-bemidone, and every substance not chemically distinguishable from them and every drug, other than cannabis to which the federal laws relating to narcotic drugs may apply.

(L) "Isonipecaine" means any substance identified chemically as 1-methyl-4-phenyl-piperidine-4-carboxylic acid ethyl ester, or any salt thereof, by whatever trade name designated.

(M) "Amidone" means any substance identified chemically as 4-4-diphenyl-6-dimethylamino-heptanone-3, or any salt thereof, by whatever trade name designated.

(N) "Isoamidone" means any substance identified chemically as 4, 4-diphenyl - 5 - menthyl - 6 - dimethylaminohexanone-3 or any salt thereof, by whatever trade name designated.

(O) "Keto - bemidone" means any substance identified chemically as 4 (3 hydroxyphenyl)-1-methyl-4-piperidyl ethyl ketone hydrochloride or any salt thereof, by whatever trade name designated.

(P) "Federal narcotic laws" means the law of the United States relating to opium, coca leaves, and other narcotic drugs.

(Q) "Official written order" means an order written on a form provided for that purpose by the United States commissioner of narcotics, under any laws of the United States making provision therefor, if such order forms are authorized and required by federal law.

(R) "Dispense" means sell, distribute, leave with, give away, dispose of, or deliver.

(S) "Registry number" means the number assigned to each person registered under the federal narcotic laws.

(T) "Prescription" means a written or oral order for a narcotic drug for the use of a particular person or a particular animal given by a practitioner in accordance with the regulations promulgated by the United States commissioner of narcotics pursuant to the federal narcotic laws.

(U) "Pharmacy" means a store or other place of business where narcotic drugs are compounded or dispensed by a pharmacist.

(V) "Nurse" means a person licensed to engage in the practice of nursing in this state.

SEC. 3719.02 MANUFACTURE, SALE AND POSSESSION OF NARCOTIC DRUGS PROHIBITED.

No person shall cultivate, grow, or by other process produce or manufacture and no person on land owned, occupied, or controlled by him shall knowingly allow to be cultivated, grown, or produced, any opium, coca leaves, cannabis, marijuana, or other narcotic drug without first obtaining a license as a manufacturer of narcotic drugs from the state board of pharmacy.

All licenses issued pursuant to this section shall be for a period of one year from the first day of July and may be renewed for a like period annually.

The annual license fee shall be five dollars and shall accompany each application for a license or renewal thereof.

SEC. 3719.10 NUISANCE.

Any store, shop, warehouse, dwelling house, building, vehicle, boat, aircraft, or any place whatever which is resorted to by narcotic drug addicts for the purpose of using narcotic drugs or which is used for the illegal keeping or selling of the same, shall be a common nuisance. No person shall maintain such a common nuisance.

SEC. 3719.10.1 PROHIBITED USE OF BUILDINGS OR VEHICLES.

No person shall knowingly permit the use of any store, shop, warehouse, dwelling house, vehicle, boat, aircraft, or any other place whatever owned or controlled by him for the illegal keeping, dispensing , or administering of narcotic drugs.

SEC. 3719.17.2 ILLEGAL POSSESSION OF INSTRUMENTS FOR ADMINISTERING DRUGS.

No person, except a manufacturer or wholesaler or retail dealer in surgical instruments, owner of a pharmacy, pharmacist, practitioner, nurse, or other person authorized to administer narcotic drugs, shall possess a hypodermic syringe or needle or any instrument or implement adapted for the use of habit-forming drugs by the subcutaneous injection for the purpose of administering habit-forming drugs, unless such possession is authorized by the certificate of a physician issued within the period of one year.

SEC. 3719.40 HALLUCINOGEN DEFINED

As used in sections 3719.41 to 3719.49, inclusive, of the Revised Code "hallucinogen" means lysergic acid diethylamide, commonly known as LSD., N - N - dimethyltryptamine, commonly known as DMT., cannabis, commonly known as marijuana, hashish, ganja, or bhang, psilocybin, mescaline, peyote, bufotenin, epena, parica, ayahuasca, yage, caapi, amanita, muscaria, and any other compound, mixture, preparation, or substance which produces hallucinations or illusions when introduced into the body.

As used in this section, "cannabis" includes all parts of the plant cannabis sativa L., whether growing or not; the seeds thereof; the resin extracted from any part of such plant; every compound, manufacture, salt, derivative, mixture, or preparation of such plant, its seeds, or resin; and tetrahydrocannabinol; but does not include the mature stocks of such plant; fiber produced from such stalks, oil, or cake made from the seeds of such plant, any other compound, manufacture, salt, derivative, mixture, or preparation of such mature stocks except the resin extracted therefrom, fiber, oil or cake, or the sterilized seed of such plant which is incapable of germination.

SEC. 3719.41 PURCHASE, USE OF, POSSESSION OR CONTROL OF, PROHIBITED; EXCEPTIONS.

No person shall, with intent to produce hallucinations or illusions, purchase, use, possess, or have under his control any hallucinogen, possession or control of any hallucinogen specifically named in section 3719.40 of the Revised Code constitutes primafacie evidence of a violation of this section, except that this section does not apply to the use, possession, or control of any hallucinogen by licensed manufacturers, wholesalers, pharmacists, owners of pharmacies, physicians, and other persons, for research, clinical, or medicinal purposes authorized by federal law or any rules or regulations adopted pursuant thereto.

SEC. 3719.46 MAINTAINING PLACE FREQUENTED BY USERS; COMMON NUISANCE.

Any store, shop, warehouse, dwelling house, building, vehicle, boat, aircraft or any place whatever, which is restored to by users of hallucinogens for the purpose of using hallucinogens or which is used for the illegal keeping or selling of the same, is a common nuisance. No person shall maintain such a common nuisance.

SEC. 3719.01.1 DEFINITIONS.

As used in the Revised Code:

(A) "Drug of abuse" means any narcotic drug as defined in section 3719.01 of the Revised Code, any barbiturate or amphetamine as defined in section 3719.23 of the Revised Code, any hallucinogen as defined in section 3719.40 of the Revised Code, any harmful intoxicant as defined in section 3719.50 of the Revised Code, and any dangerous drug as defined in section 4729.50 of the Revised Code.

(B) "Drug dependent person" means any person who, by reason of the use of any drug of abuse, is physically, psychologically, or physically and psychologically dependent upon the use of such drug, to the detriment of his health or welfare.

(C) "Person in danger of becoming a drug dependent person" means any person, who, by reason of his habitual or incontinent use of any drug of abuse, is in imminent danger of becoming a drug dependent person.

SEC. 3719.50 DEFINITION.

(A) Except for lawful research, clinical, or medical purposes, no person, with intent to induce intoxication or similar physiological effects, shall purchase, possess, have under his control, use, or administer to another any harmful intoxicant.

(B) As used in this section, "harmful intoxicant" does not include beer or intoxicating liquor, but means any compound, mixture, preparation, or substance the gas, fumes, or vapor of which when inhaled can induce intoxication, excitement, giddiness, irrational behavior, depression, stupefaction, paralysis, unconsciousness, asphyxiation, or other harmful physiological effects, and includes without limitation the following:

(1) Any volatile organic solvent, or plastic cement, model cement, fingernail polish remover, lacquer thinner, cleaning fluid, gasoline, or other preparation containing a volatile organic solvent;

(2) Any aerosol propellant;

(3) Any fluorocarbon refrigerant;

(4) Any anesthetic gas.

DRUG & NARCOTICS

IDENTIFICATION CHART

DRUG USED & SLANG NAME	PHYSICAL SYMPTOMS	LOOK FOR	DANGERS
GLUE SNIFFING	▪ Violence, drunk appearance, dreamy or blank expression. Odor of glue on breath, excess nasal secretions, watering of eyes, poor muscular control	▪ Tubes of glue, glue smears, paper or plastic bags, and handkerchiefs	▪ Lung, brain, nervous system, liver damage, death through suffocation or choking, anemia
HEROIN, MORPHINE— Snow, stuff, H, junk, M, dreamer, smack, & scag	▪ Stupor, drowsiness, needle marks on body, watery eyes, loss of appetite, bloodstain on shirt sleeve, "on the nod," constricted (small) pupils—do not respond to light—inattentive, slow pulse, and respiration	▪ Needle or hypodermic syringe, cotton, tourniquet, in form of string, rope or belt, burnt bottle caps or spoons, glassine envelopes, traces of white powder around nostrils from sniffing, or inflamed membranes in nostrils, small capsules containing white powdered substance	▪ Death from overdose, addiction, severe infections from use of dirty needles or equipment
COCAINE— Leaf, snow, speedballs	▪ Muscular twitching, convulsive movements, strong swings of mood, exhilaration, hallucinations, dilated pupils	▪ White odorless powder	▪ Convulsions, death from overdose, feelings of persecution, psychic dependence
CODEINE OR OPIUM ADDITIVES— Schoolboy	▪ Drunk appearance, lack of coordination, confusion, excessive itching . . . all from large doses. Small doses exhibit little effect.	▪ Empty bottles or cough medicine or paregoric	▪ Causes addiction
MARIJUANA— Joints, sticks, reefers, pot, weed, grass, muggles, mooters, Indian hay, locoweed, Mu, Mary Jane, griffo, mohasky, gigglesmoke, jive	▪ Sleepiness, or talkative and a hilarious mood, enlarged pupils, lack of coordination, craving for sweets, increased appetite, "high" feeling, erratic behavior, loss of memory, distortions of time and space	▪ Smell of burnt leaves or rope with characteristic sweetish odor, small seeds, brown or off-white cigarette paper, discolored fingers, pipes	▪ Damage to liver, inducement to take stronger drugs, act in manner dangerous to self or others. Accident prone, anti-social behavior
LSD, DMT, STP— Acid, mescaline (Hallucinogens)	▪ Severe hallucinations, feelings of detachment, incoherent speech, cold sweaty hands and feet, vomiting, laughing, crying, exhilaration or depression, suicidal or homicidal tendencies, shivering, chills, with goose pimples, irregular breathing	▪ Strong body odor. Small tube of liquid, tablets, capsules, ampuls of clear liquid. Small green or blue tablets . . . dotted pink and white tablets	▪ Suicidal tendencies, unpredictable behavior, brain damage from chronic usage. Hallucinations, panic, accidental death, feeling of persecution
PEP PILLS— Bennies, co-pilots, ups, footballs, hearts, speed, crystal (Amphetamines, Methamphetamine)	▪ Aggressive behavior, giggling, silliness, rapid speech, confused thinking, no appetite, extreme fatigue, dry mouth, bad breath, shakiness, dilated pupils, sweating, licks lips and rubs and scratches nose excessively, chain smoking, extreme restlessness, and irritability, violence, and a feeling of persecution, abcesses	▪ Pills of varying colors, tablets or capsules, chain smoking, syringes	▪ Hallucinations, death, from overdose, speeds rate of heart beat, and may cause permanent heart damage or heart attacks, loss of weight, addiction, mental derangement, suicidal depression may accompany withdrawal
GOOF BALLS— Downs, red birds, yellow jackets, blue heavens, barbs (Barbiturates)	▪ Drowsiness, stupor, dullness, slurred speech, drunk appearance, vomiting, sluggish, gloomy, staggers, quarrelsome, incoordination, with no alcohol odor on breath	▪ Tablets or capsules of varying colors, syringes	▪ Death from overdose, addiction, unconsciousness, coma, convulsions, psychosis or death from abrupt withdrawal

COMMON SYMPTOMS OF DRUG ABUSE

A. Changes in school attendance, discipline and grades. B. Change in the character of homework turned in. C. Unusual flare-ups or outbreaks of temper. D. Poor physical appearance. E. Furtive behavior regarding drugs and possessions. F. Wearing of sunglasses at inappropriate times to hide dilated or constricted pupils. G. Long-sleeved shirts worn constantly to hide needle marks. H. Association with known drug abusers. I. Borrowing of money from students to purchase drugs. J. Stealing small items from school. K. Finding the student in odd places during the day such as closets, storage rooms, etc., to take drugs.

Reprinted with permission of: 1969 Acropolis Books/Colortone Inc., Washington, D.C. 20009

CHAPTER XVIII

FRACTURES

DEFINITION

A fracture is any break in the continuity of a bone. The break may be incomplete with only a line in the bone or completely crushed with related tissue damage.

TYPES OF FRACTURES

All fractures are classified as either simple or compound.

A simple or closed fracture is one in which there is no connection between the broken bone and the body's outer surface. The skin in the area of the fracture is not broken and wounds are not present.

A compound or open fracture is one in which the fracture is in communication with the outer surface of the body. The skin is torn or broken by the same force that has broken the bone, or by the force causing the bone to pierce the skin. Compound fractures can also be caused by gunshot wounds piercing the skin and breaking the bone or by other penetrating materials. In emergency care, any skin injury near a broken bone should be treated as a compound fracture. Great care must be taken to treat all suspected open fractures, for bacteria can enter the wound from many sources, extend to the bone, and cause an infection. Infected bones heal very slowly which results in a delayed repair process and the possibility of occasional loss of a limb, if not life itself.

ADDITIONAL SUBDIVISIONS OF SIMPLE OR COMPOUND FRACTURES

An impacted fracture is one in which the bone is broken and one end is forcibly driven into the interior of the other.

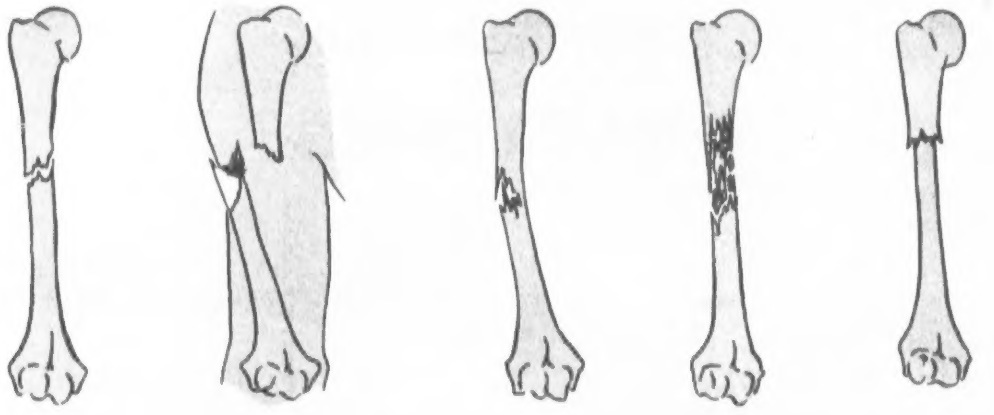
A complicated fracture is one in which other structures or organs such as nerves, blood vessels, lungs, or bladder are damaged by the force, of by the fracture fragments, such as a broken rib puncturing a lung.

A greentwig fracture (sometimes referred to as an incomplete fracture) is one in which a bone bends and merely cracks without a loss of continuity and with little or no displacement. This type, similar to the breaking or bending of a greentwig from a tree, is very common in children whose bones are soft.

A comminuted fracture is one in which the bone is broken into many pieces. The bone has several breaks and may be crushed and splintered. See Figure 1.

GENERAL SIGNS AND SYMPTOMS

The following are signs and symptoms of fractures. Not all of the listed signs and symptoms will be present in every fracture, but the presence of any should confirm the possibility of a fracture. The squadmen will act accordingly. The nature of the accident and the location of the victim are additional points to consider.



SIMPLE COMPOUND GREENTWIG COMMINUTED IMPACTED

FIGURE 1. Types of fractures

Pain is usually severe and generally at the fracture site. Pain and tenderness will be relieved by splinting, but will return with any movement or undue aggravation.

Loss of motion may be the result of many things. Movement is not possible because muscle function is dependent upon the bones to which the muscles are attached. The fracture may be near a joint which would limit motion; or, the victim makes no attempt to move the part because of the severe pain.

Deformity is present in most complete fractures. There will be varying degrees of displacement, and this can be felt by gently running the fingers along the bone. In the most severe accidents, the limb may be totally misdirected with obvious angulation. Comparison of corresponding body parts may indicate an unnatural position. Overlapping of the broken ends of the bone may present a shortening of a limb.

Swelling and discoloration may occur immediately if excessive bleeding is present, or it may not occur until later. Swelling, in many cases, is nature's way of protecting the tissues surrounding the sharp ends of the broken bone; lymph and tissue fluids gather around the area and assist in forming a natural cushion. However, swelling due to the buildup of lymph and tissue fluids indicates damage to the soft tissue.

Grating sensations (crepitus) may be felt when examining the victim or a grating sound may be heard. The broken ends of the bone rub against each other giving off the grating sensation or sound. Never create this grating intentionally, for it may increase the damage to the bone ends and its surrounding soft tissue.

ESSENTIAL POINTS IN THE EMERGENCY CARE OF FRACTURES

1. Do not move the victim until fractures are immobilized. The only exception would be the immediate danger of fire, explosion, cave-in, etc., and then the victim should be dragged in the long axis of the body.

2. For compound fractures, control the bleeding and cover the wound with a sterile dressing before applying splints. Compound fractures with a

protruding bone must be handled carefully to prevent the exposed bone from slipping back into the envelope of the skin.

3. Straighten all fractures of the long bones to as near a normal position as possible before splinting.

4. Do not straighten suspected fractures of the knee or elbow.

5. Immobilize all fractures above and beyond the adjacent joints.

6. Apply slight traction while splinting and maintain traction until the splint is securely in place.

7. Splints are to be applied snugly but not so tight as to interfere with circulation. Pad all splints and add additional padding to deformities.

8. Suspect neck and back injuries in any accident that could cause fractures.

9. Treat for shock.

10. Regardless of distance or travel time from the accident scene to the hospital, all fractures must be immobilized.

11. Transport carefully and comfortably to prevent aggravation of the injured part.

Proper emergency care for fractures will prevent further injury to muscles, nerves, and blood vessels; prevent simple fractures from becoming compounded; relieve possible pressure on blood vessels and nerves; reduce bleeding, and reduce pain.

IMMOBILIZATION EQUIPMENT AND MATERIAL

SPLINTS–DEFINITION AND PURPOSE

A splint is a rigid support for a fractured or injured extremity or other part of the body. Its purpose is to prevent movement of the broken or injured part.

Commercial splints are made from metal, wood, and plastic. Improvised splints can be made from a variety of material. Some that may be used are pillows, blankets, cardboard, magazines, or the natural splint, tying one leg to the other or one finger to the other. All splints must be well padded, with attention to bony or tender areas as the knee, ankle, elbow and shoulder; and to depressions such as the groin and underarm.

Splints are held in place by roller bandages, cravats, and sometimes adhesive tape. Elastic bandages are not recommended for applying splints. Because of the elastic properties, it is possible to inadvertently apply splints too tightly.

If a splint is improperly padded or applied too tightly, pressure will cause swelling and pain with injury to tissues, possibly resulting in permanent damage.

TYPES OF SPLINTS

There are many types of splints that are used in the emergency squad service. Some are manufactured for commercial distribution; others are "home-made" by the local squads; and still may others are adapted from improvised material. Regardless of the types used by your squad, the "essential points" listed previously must be followed completely.

The most common types of splints and splinting material are cravat bandages, triangular bandages, board splints, traction splints, plastic inflatable splints, and blanket-roll splints.

Cravat bandages are used to secure rigid splints to the fractured part, and to immobilize fractures of the ribs, collar bone, lower jaw, shoulder blade, and some fractures of the upper arm (humerus). Cravats can be folded to produce a narrow, medium, or wide bandage for proper application to a particular fracture or size of the victim. They are used in conjunction with a sling for fractures of the collarbone, shoulder blade, and the upper arm.

Triangular bandages are used primarily as a sling to support a fractured or dislocated part.

Board splints must be constructed of material comparable to four-ply wood. For fractures of the thigh the splints must be 4 1/2 feet long and 3 inches wide. Boards 3 feet long by 3 inches wide are suitable for fractures of the leg, and for fractures of the forearm, wrist and hand, boards measuring 15 inches by 3 inches are required. Splints made of cardboard, plastic, or slatted canvas may be used for fractures of the forearm and wrist. All splints must be well padded with a soft material. If improvised traction is to be applied with board splints, additional padding must be placed at those points of the body (the groin and the ankle) that will receive the greatest pressure.

Traction splints are required for treatment of lower extremity fractures, particularly those of the femur. The only traction splint to be discussed in this text will be the "half-ring" traction splint. It is listed as essential equipment and is the traction splint of choice, being recommended by orthopedic surgeons throughout the nation.

The half-ring splint can be applied to either leg by manually reversing the padded half-ring at the top of the splint. To position the splint, one squadman applies gentle traction to the victim's leg, while the other squadman places the splint in position, with the shorter side inside the leg and the longer side on the outside of the leg. The leg is supported and tied to the splint with cravat bandages. The shoe is left on and a pad is placed about the ankle. Use two cravats to make a hitch and a windlass to apply just enough traction to immobilize the leg. If the victim is conscious, he will usually let you know when it feels comfortable.

The greatest danger in applying a traction splint is too much pressure being applied over the foot and ankle causing circulation to be cut off.

Commercial ankle hitches that are designed to minimize pressure on the ankle and foot are available. Local availability of the commercial hitch should limit the use of cravat bandages and other improvised hitches.

Many leading orthopedic surgeons have indicated that when traction has been properly applied there is:

A marked decrease in the severity of shock,

Considerably less pain,

Less damage to surrounding tissues, blood vessels, and nerves,

A reduction in the length of disability;

whereas a fracture of a long bone that has been transported without traction results in added injury to blood vessels, muscles, and nerves; and progressing to coagulation of the blood, the formation of clots, and total destruction of the surrounding cellular tissue.

Plastic Inflatable Splints are recommended only for fractures at or below the knee and at or below the elbow. The splint should not be put on over bare skin. Cover the limb with gauze or compresses to prevent possible skin irritation if the splint should be left on for an extended period.

There are two common types of inflatable splints--one that has a zipper, and the other that must be "threaded" over the victim's arm or leg. Care must be taken with the zipper type, for as we all know, zippers do get caught in the strangest places and at the most inopportune times. This mechanical problem may be overcome with proper inspection and maintenance. The threaded type has caused some problems primarily from improper application. The following method has proven to be the most effective:

> The splint is threaded over the squadman's arm. He then grasps the injured limb of the victim. The splint is then threaded over the victim's limb and inflated.

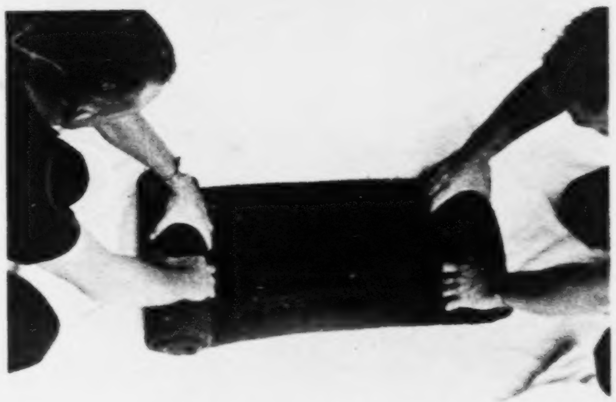
Inflatable splints can also be used to control bleeding and to cover burns. Sterile material is placed over the wound or burned area. The splint is applied carefully and inflated.

NOTE: Air splints are to be inflated by lung pressure only. A properly inflated splint can be slightly indented with the thumb.

BLANKET ROLL SPLINTS

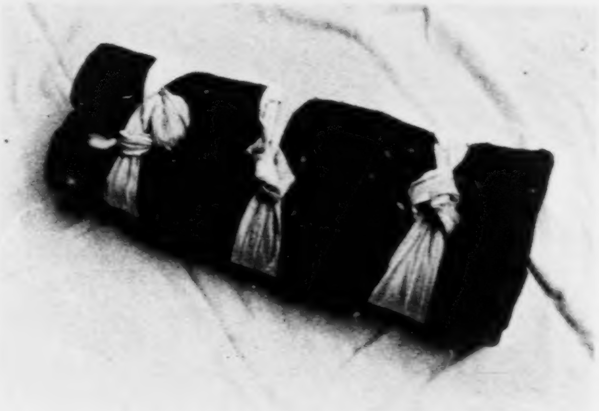
A blanket roll is one of the most commonly improvised splints. Figures 2 through 9 deal with making and applying blanket roll splints.

Two sizes should be carried: a short roll (12" to 16") for possible neck fractures, and a long roll (22" to 26") for arm and leg fractures.



Courtesy Sharon Twp. F.D., Worthington, O.

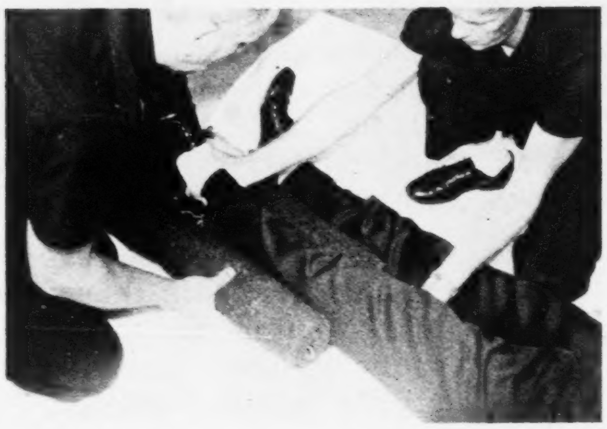
FIGURE 2



Courtesy Sharon Twp. F.D., Worthington, O.

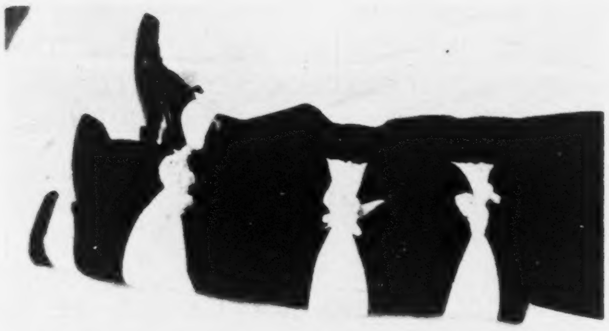
FIGURE 3

To make a blanket roll splint, fold a blanket until it is 12" to 16" wide. Roll it from both ends toward the center, tucking all wrinkles under (Figure 2.) Then tie it with 3 cravat bandages (Figure 3.) When the splint is needed, the cravats will be immediately available.



Courtesy Sharon Twp. F.D., Worthington, O.

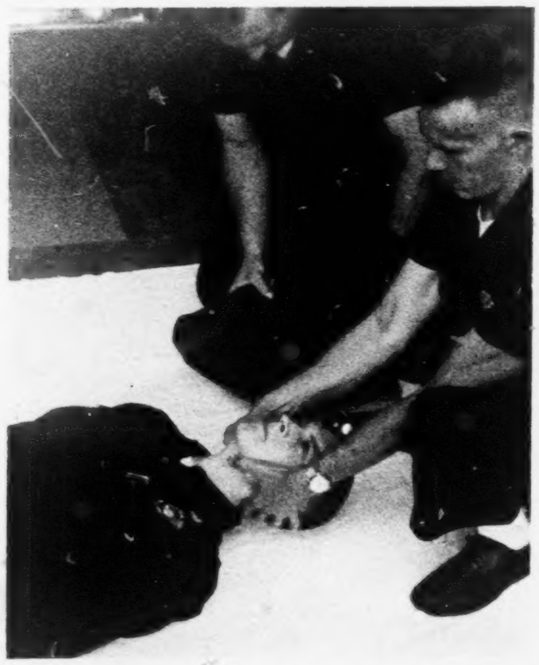
FIGURE 4



Courtesy Sharon Twp. F.D., Worthington, O.

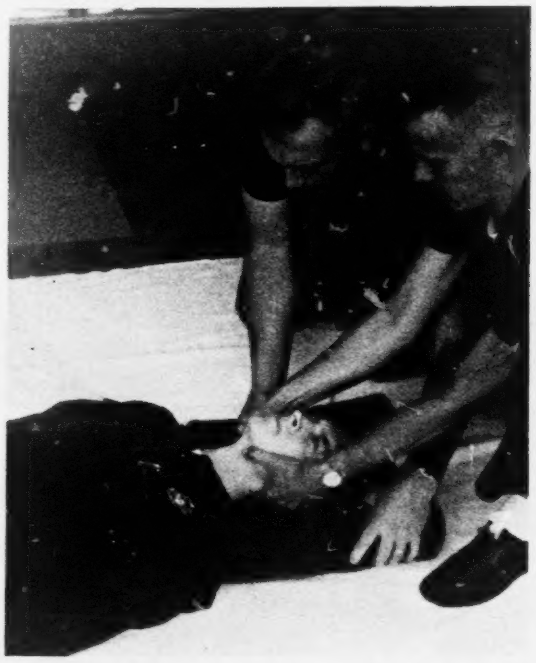
FIGURE 5

The long blanket roll splint can be applied to the extremities. Figure 4 shows the proper supporting of a suspected fracture and the application of the splint. Figure 5 shows the splint in place.



Courtesy Sharon Twp. F.D., Worthington, O.

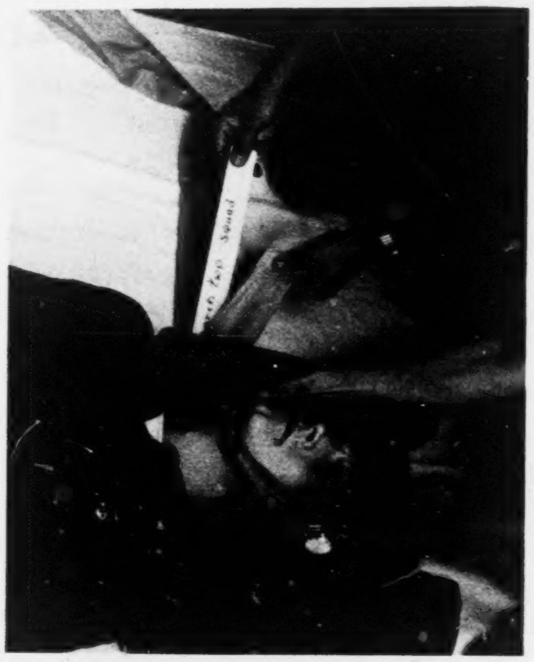
FIGURE 6



Courtesy Sharon Twp. F.D., Worthington, O.

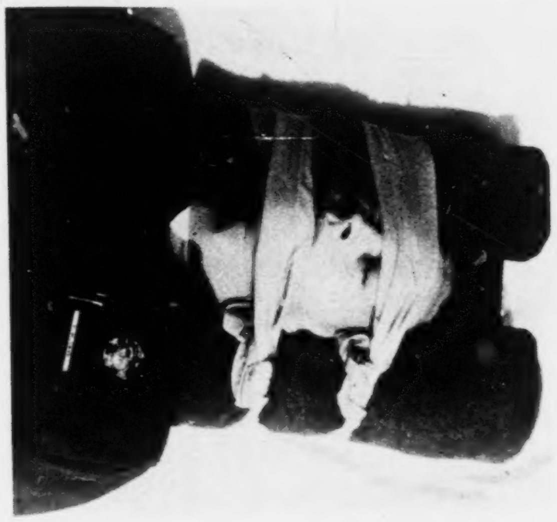
FIGURE 7

Figure 6 shows the proper way to hold a head when a fracture of the neck is suspected. One squadman is preparing the short blanket roll splint. Figure 7 shows how to place the blanket roll splint gently under the victim's head. The rolls on each side of the head must be placed firmly on the victim's shoulder and next to his head.



Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 8



Courtesy Sharon Twp. F.D., Worthington, O.

FIGURE 9

The cravats are pushed under the blanket with a flat, thin blade (Figure 8.) They can be brought down the splint from the top. Figure 9 shows the splint in place. It is positioned tightly against the victim's shoulders and head, to immobilize his head and neck.

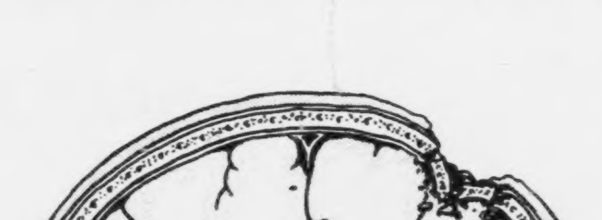
"There is no such thing as a universal splint." No single splint is ideal for all fractures. The squadmen must apply the proper splint and splinting material according to the nature and body location of the broken bone.

SPECIFIC FRACTURES - SIGNS - SYMPTOMS AND CARE

SKULL FRACTURES

A fracture of the skull is a break in the bony structure forming the skull. The break may occur on the top, front, sides, or back of the head. All skull fractures are serious due to possible brain injury. Wounds may or may not be present. See Figure 10.

FIGURE 10. Fracture of the skull ➡



SIGNS AND SYMPTOMS

It is usually very difficult to determine the actual location of a skull fracture. However, when there is the slightest suspicion of a skull fracture, it should be treated as such. The victim may or may not have a visible injury on the head. He is usually dazed and shows signs of faintness, dizziness, and progression into unconsciousness. Bleeding from the nose, mouth or ear indicates fractures at the base of the skull. Pupils of unequal size indicates injury to the brain either by pressure or bleeding. Concussion of the brain may be confused with a skull fracture, but as the care for both is similar, there is no need to distinguish between them.

EMERGENCY CARE

The squadman should keep the victim quiet and lying down with the head slightly elevated. If the location of the fracture is known, the victim's head should be positioned to rest away from the fracture site. If a wound is present, control the bleeding and apply a sterile dressing, being careful to avoid pressure on a "soft" spot or depression. This will prevent depressing bone fragments into the brain. Support with oxygen and maintain an open air passage. If there is excessive bleeding from the mouth or nose, the victim should be positioned to prevent aspiration of the blood. Bleeding from the ear should not be controlled except to loosely apply a sterile compress to absorb the flow. Keep the victim warm, give nothing by mouth, and transport to the hospital. The majority of victims with head injuries should be transported on their sides to provide adequate drainage of fluids, vomitus and blood.

Occasionally, the victim of a head injury displays violent reactions. If so, he must be carefully restrained to prevent further injury.

NOTE: Remember to control bleeding but not drainage. Remember to suspect neck and back injuries of all victims with head injuries.

SPINE FRACTURES (NECK AND BACK)

All fractures of the neck and back are serious and all require prompt recognition and care. Because of the spinal cord and the nerves within, any injury of the neck and back should be handled with caution. In any accident which could cause a fracture, the squadmen must suspect and look for a spinal fracture, particularly if the victim is unconscious.

The way these victims are handled will make the difference between complete recovery, permanent disability, and death.

NECK FRACTURES

The neck (cervical spine) is a common location of injuries to the spinal column. Automobile accidents and falls are the most frequent causes of neck injuries that may range from the so-called "whiplash" to complete severance of the spinal cord.

SIGNS AND SYMPTOMS

The cause of the accident and the position of the victim may provide sufficient evidence to the squadmen. The victim will complain of pain at the fracture site, and numbness or tingling, or there may be complete paralysis from the point of fracture on down. Breathing will be impaired, and the contents of the bowel and bladder may be expelled. Obvious deformities are rare.

EMERGENCY CARE

The head, neck, and trunk must be kept straight, with traction applied to the head to prevent any motion. If the victim is lying on the ground, he must be logrolled onto a backboard, maintaining the traction, and keeping his "nose" in line with his "belly-button" during the logrolling. Maintain traction until the neck is immobilized completely. The use of a cervical collar, blanket roll splint, sand bags, or similar material should be used to prevent motion. See Figure 11. The victim may be transported flat on his back. The victim can be, however, transported on his side, with proper immobilization, to facilitate the flow of fluids or vomitus.

Victims of automobile accidents with suspected neck fractures can be immobilized prior to extrication with the half-board. See Chapter XXVI for this procedure.

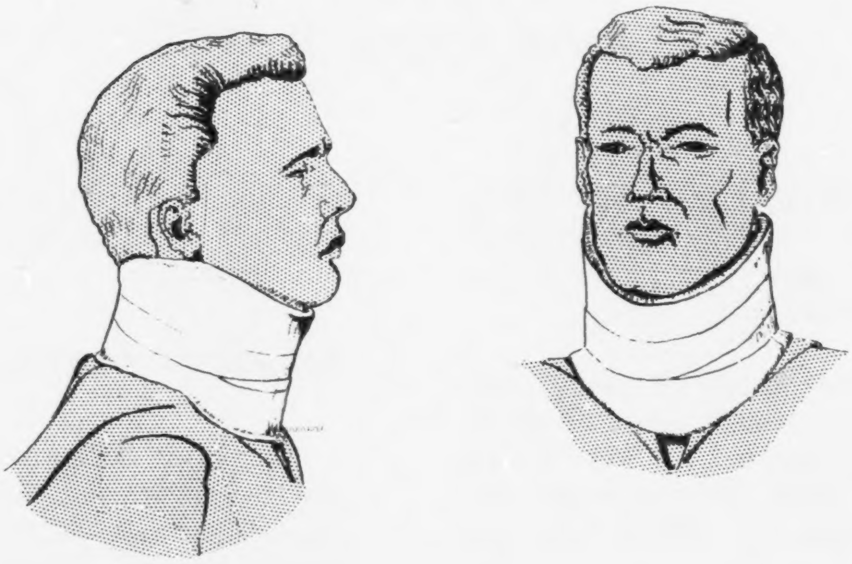


FIGURE 11. Immobilization for fracture of the neck

BACK FRACTURES (THORACIC AND LUMBAR REGIONS)

The cause and symptoms of a broken back are the same as those for a broken neck, but paralysis from the back fracture usually spares the arms. For as was previously indicated, paralysis will occur from the fracture site on down. See Figure 12.

EMERGENCY CARE

The care for a broken back is the same as for a broken neck. Even though neck traction is not necessary, the neck must be supported during the logrolling procedure. See Chapter XXIV, Page 257.

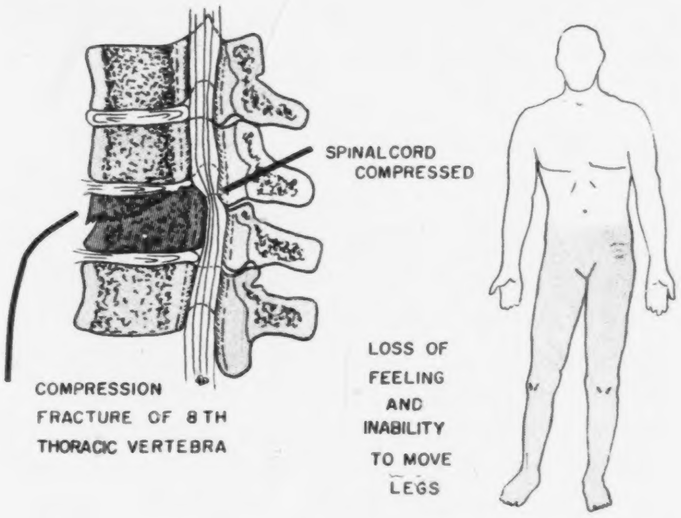

SPINAL CORD COMPRESSED
COMPRESSION FRACTURE OF 8TH THORACIC VERTEBRA
LOSS OF FEELING AND INABILITY TO MOVE LEGS

FIGURE 12. Complication of fracture of spine

PELVIC FRACTURES

Most pelvic fractures result from automobile accidents; falls and accidents that produce a squeezing or crushing force cause the others.

Pelvic fractures must be considered dangerous because many associated injuries may be present. The sharp bone fragments may have pierced the bladder, intestines or other internal organs.

SIGNS AND SYMPTOMS

The victim will be in shock resulting from severe pain and internal bleeding from damaged blood vessels and other internal organs. He will be unable to use the lower extremeties because of the pain and muscle spasm. Pelvic fractures may range from one causing only pain to one exhibiting a marked deformity with severe internal damage.

EMERGENCY CARE

A pelvic fracture requires careful, gentle treatment from the initial examination through transport. The knees and ankles should be bandaged together, with a pad placed between the thighs. The knees may be kept straight or partially bent, whichever is more comfortable for the victim. If bent, padding should be placed under the knees. Wrapping of the pelvis with a wide cravat bandage and suitable padding will add to the victim's comfort, but this must be done without rolling the victim. See Figure 13.

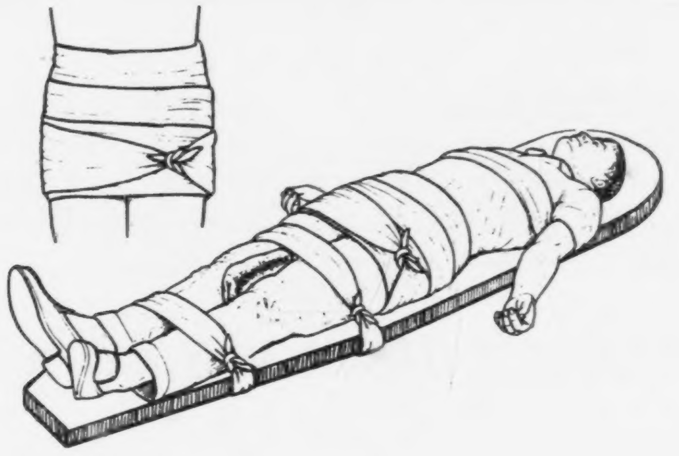


FIGURE 13. Improvised splinting of a pelvic fracture, using one or more cravats depending upon the size of the victim. The victim is transported on a board in the face-up position.

Place the victim on a backboard, preferably by lifting with at least four people, and only high enough to slide the board under the victim. Rolling is not indicated due to the possibility of causing additional damage to the internal organs. Secure the victim to the board, treat for shock, and transport carefully to avoid situations and motions that may aggravate the victim's condition.

NOSE FRACTURES

A fracture of the nose is a common injury that results from a direct blow. It is not difficult to detect due to a marked deformity.

SIGNS AND SYMPTOMS

Such a fracture may be simple or compound. There is usually considerable deformity, severe pain, bleeding, and swelling. A grating sensation (crepitus) can usually be felt.

EMERGENCY CARE

The immediate application of cold compresses will help to reduce the swellling, bleeding and pain. If a splint is necessary, it can be made by using two small rolls of narrow bandage, one on either side of the nose, and held in place with strips of adhesive tape. See Figure 14.

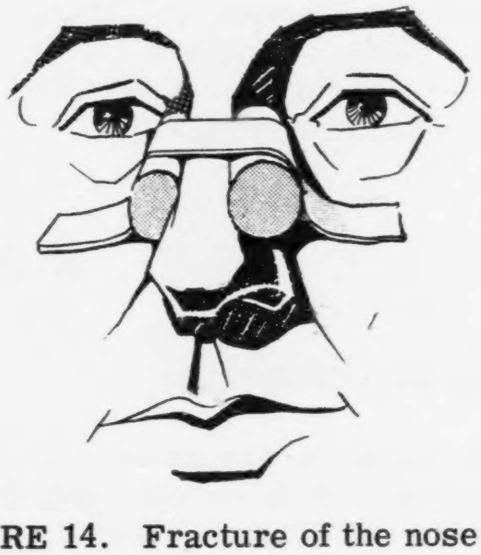


FIGURE 14. Fracture of the nose

UPPER JAW OR CHEEKBONE FRACTURES

In fractures of the upper jaw or cheekbone, where there are open wounds, treat as for wounds of the face. No dressing is required in the absence of open wounds. Excessive bleeding will require measures to insure the maintenance of an open airway. Transport to the hospital, for the victim may require both medical and dental care.

LOWER JAW FRACTURES

A broken lower jaw is usually the result of a direct blow and occurs much more frequently than a fracture of the upper jaw.

SIGNS AND SYMPTOMS

This type of fracture is easily identified, for the victim has difficulty in speaking and exhibits severe pain if efforts are made to open or close the mouth. The teeth are uneven, with some possibly loosened or knocked out. Bleeding from the mouth is common, originating about the gums near the fracture site. An obvious deformity and/or swelling may be present.

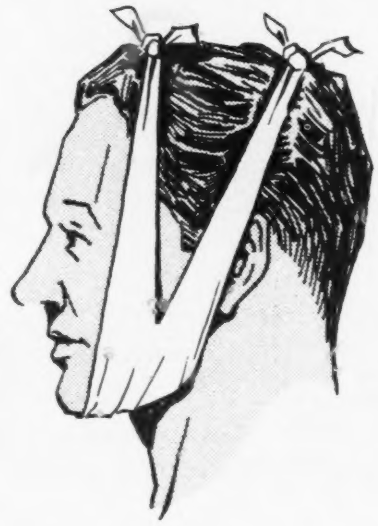


FIGURE 15. Bandage for a fractured jaw

EMERGENCY CARE

The application of cold compresses may reduce the swelling and pain. The jaw must be immobilized by having the victim close his mouth (as much as possible depending on the degree of deformity), and applying a four-tailed bandage (see Figure 15) or the dressing indicated for a dislocated jaw. If the immobilization procedure for a dislocated jaw is used, do not use the wedge between the teeth.

RIB FRACTURES

CAUSE AND SYMPTOMS

Rib fractures are usually the result of a direct blow to the rib cage. Severe pain when breathing, bending or twisting the body are common symptoms. There is tenderness at the fracture site and usually little displacement or deformity. If a lung has been punctured, the victim may cough up bright red frothy blood.

EMERGENCY CARE

Immobilization consists of applying three wide cravats to cover the entire rib cage on the injured side. The first cravat is applied to the lowest part of the rib cage, the second cravat should overlap the first about one third, the third overlapping the second and extending to the armpit. A pad is placed on the opposite side of the body under the knots which have been tied loosely in place. The victim is asked to exhale and as he does each knot is tightened. Correctly applied, this method of immobilization will provide immediate relief of pain.

A broad binder or adhesive strapping may also be used to immobilize rib fractures. See Figure 16.

If a lung has been punctured, maintain an open airway, aspirate fluids and transport.

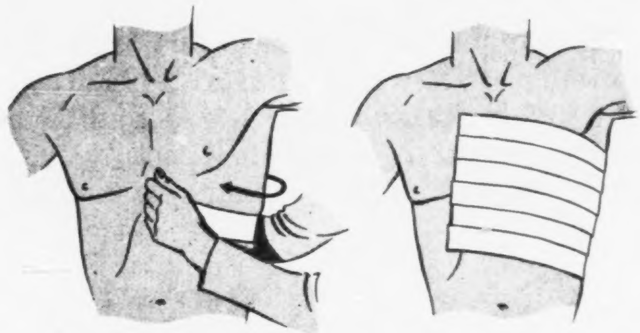


FIGURE 16. Strapping of a fractured rib

COLLAR-BONE FRACTURE (CLAVICLE)

CAUSE AND SYMPTOMS

Fractures of the clavicle are usually the result of falling on an outstretched hand with the force being transmitted to the shoulder.

The shoulder on the injured side will droop somewhat downward and forward. Because the clavicle lies immediately under the skin, a deformity may be seen. As in other fractures, there will be pain and tenderness and a grating sensation may be felt. Although a rare complication, fragments of the bone may injure the blood vessels to the arm which pass close beneath the clavicle.

EMERGENCY CARE

Immobilization to hold the shoulders up and back can be accomplished by applying a figure-of-eight bandage. The bandage should be firm and padding should be placed over the shoulder and at the armpits to prevent discomfort. See Figure 17. Another method is to place the arm, on the injured side, in a sling. Then secure the arm and sling to the body with a wide cravat bandage.

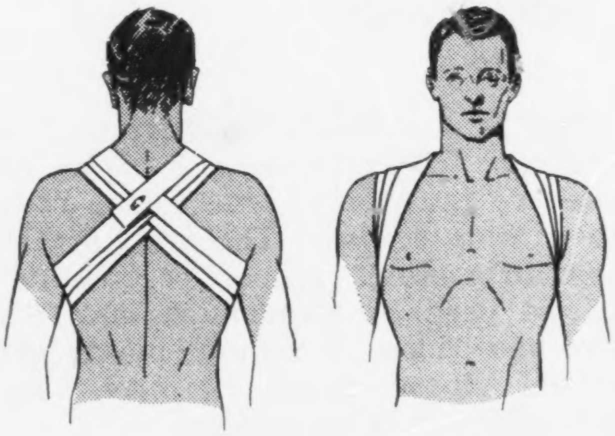


FIGURE 17. Bandage for fractured clavicle

SHOULDER BLADE FRACTURES (SCAPULA)

CAUSE AND SYMPTOMS

Fractures of the scapula are not common. They are caused by a direct blow over the shoulder blade and generally result in a simple fracture with little displacement. There is usually pain at the fracture site, swelling, and the inability to swing the arm.

EMERGENCY CARE

Place the arm, on the injured side, in a sling, then secure the arm and sling to the body with a wide cravat bandage.

UPPER ARM FRACTURES (HUMERUS)

CAUSE AND SYMPTOMS

Fractures of the humerus may often be complicated because of the nerves and blood vessels that lie close to the bone. The ususl symptoms are pain, swelling, deformity and loss of motion. See Figure 18.

EMERGENCY CARE

This is a difficult fracture to immobilize. The procedure of choice is to secure the injured arm to the body with a wide cravat. The arm is then placed in a sling. A short board splint may be used in conjunction with the above procedure. If the arm is straight and the elbow cannot be bent, long board splints may be applied.

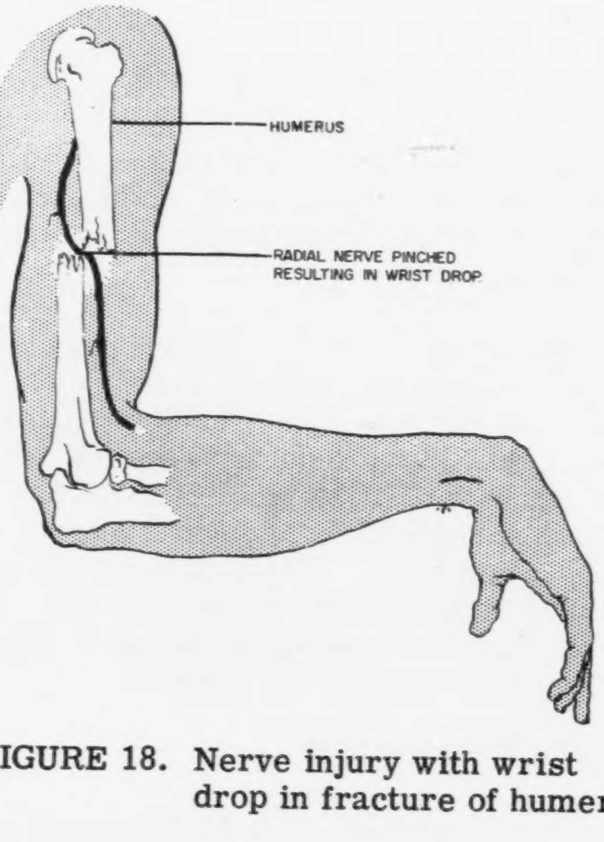


FIGURE 18. Nerve injury with wrist drop in fracture of humerus

ELBOW FRACTURES

CAUSE AND SYMPTOMS

The fracture usually results from a fall or a direct blow to the elbow. Pain, deformity, swelling, grating sensation, and loss of motion may be present.

EMERGENCY CARE

Fractures of the elbow are to be immobilized in the position found. If found straight, splint them straight; if found bent, splint them bent. If the arm is found straight, a full board splint, or a full arm plastic splint may be used. If the arm is found bent, an L-shaped splint, having the angle of the arm's position, can be prepared by tying two short board splints together. The splinted arm is then placed in a sling.

Never attempt to align a suspected elbow fracture.

LOW ARM FRACTURES (RADIUS AND ULNA)

CAUSE AND SYMPTOMS

When both bones of the forearm are broken, all the usual signs of a fracture are present. When only one of the bones is broken, the other acts as a splint and there is pain, little deformity, and sometimes inability to use the arm.

EMERGENCY CARE

Immobilization of this fracture can be accomplished by using padded board splints, inflatable splints, or even magazines. It should be splinted in the most comfortable position.

WRIST AND HAND FRACTURES

CAUSE AND SYMPTOMS

The wrist is usually broken by a fall on the outstretched hand. The bones of the hand and fingers are fractured as a result of direct blows. The most common wrist fracture is the "Colles" fracture shown in Figure 19. There is pain, tenderness, and swelling with some deformity. The knuckles of broken fingers appear larger than the knuckles of corresponding fingers.

EMERGENCY CARE

Immobilize the wrist by using padded board splints, inflatable splints or magazines. The hand can be immobilized using a short wooden splint and padding to hold the hand in a cupped position. The use of a tongue blade and bandage is sufficient for a broken finger.

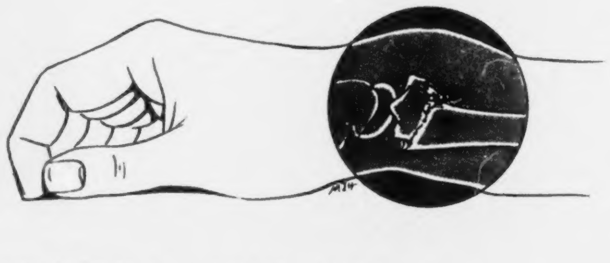


FIGURE 19. Colles' fracture

HIP FRACTURES

CAUSE AND SYMPTOMS

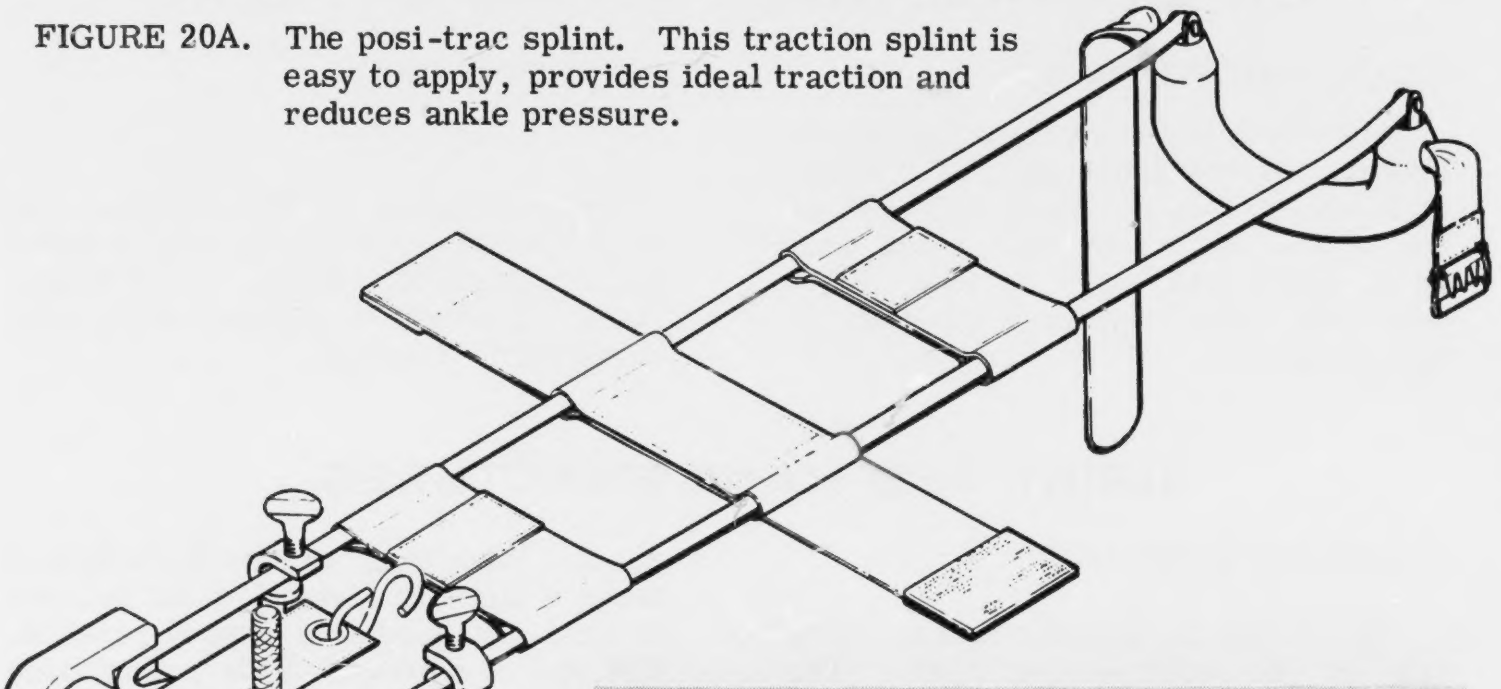
A broken hip is usually the result of a fall, and should be suspected of all victims who complain of pain in the hip following an injury. Hip fractures involve a large surface of bone that produces severe pain. The victim will be unable to lift his leg, and due to bone displacement, circulation will be impaired. Generally, the affected leg and foot turns outward. Shock will accompany this injury.

EMERGNECY CARE

In all instances of fractures of the hip, as with other fractures, splinting must be accomplished before moving the victim. The victim should not be permitted to stand or sit up. A half-ring traction splint should be applied. See Figures 20A and 20B.

If a long board splint is used, it should be well padded and extend from the victim's feet to a point just below the shoulder. Treat for shock and transport the victim on a backboard.

FIGURE 20A. The posi-trac splint. This traction splint is easy to apply, provides ideal traction and reduces ankle pressure.



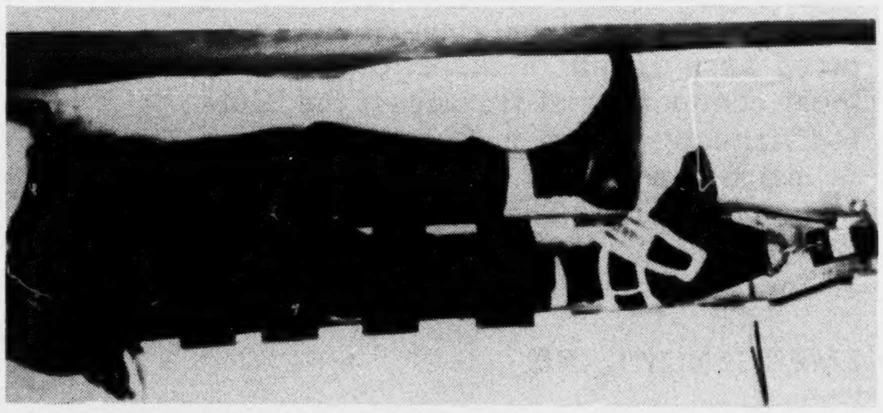


FIGURE 20B. The posi-trac splint in place

THIGH FRACTURES (FEMUR)

CAUSE AND SYMPTOMS

This fracture is often due to falls or a direct force or blow to the thigh. In the elderly, a simple accident such as a mis-step or slight fall may cause a fracture. When the break occurs, there is often considerable bleeding and soft tissue damage that produce shock. Severe pain, deformity, loss of motion, shortening, grating, and angulation are common symptoms associated with this fracture.

EMERGENCY CARE

The victim should be kept lying down, kept warm, and treated for shock. The leg should be placed in as near a normal position as possible under slight traction. Traction must be maintained during immobilization to reduce pain and further tissue damage.

The splint of choice is the half-ring traction splint. See Page 188 (of this Chapter) for application of this splint and statements recommending the use of traction for fractures of the long bones, particularly the femur.

KNEE FRACTURES

CAUSE AND SYMPTOMS

Fractures of the knee and/or the kneecap (Patella) occur frequently to victims of auto accidents. Falls are probably the most common cause, and it is usually the kneecap that is fractured. In addition to the general symptoms of all fractures, the victim is unable to kick the leg forward, and if he has made an attempt to walk, the injured leg will "drag.'"

EMERGENCY CARE

Fractures of the knee and knee area should be treated the same as fractures of the elbow. No attempt should be made to straighten the limb, due to possible damage to blood vessels and nerves.

If the leg is found straight, half-ring, board, or an inflatable full leg splint may be used. If the leg is found bent, an improvised splint, conforming to the angulation, must be applied. See Figure 21.

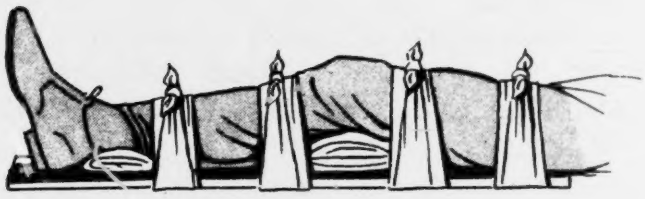


FIGURE 21. Immobilization for transportation of fractured patella.

LOWER LEG FRACTURES (TIBIA AND FIBULA)

CAUSE AND SYMPTOMS

Breaks of the lower leg often result from various accidents and can be considered a common fracture site.

The tibia, or shinbone, is large and sturdy, and its entire length can be felt in the front of the leg. There is very little tissue in front of the tibia, and fractures of this bone are easily compounded. The fibula, which is smaller, lies on the outside section of the leg and it can be felt at its lower end near the ankle.

When only one bone is broken the other acts as a splint, but if both bones are broken, there may be an obvious deformity at the fracture site. Pain, swelling, and grating will be present in fractures of either bone.

EMERGENCY CARE

Align the leg to as near a normal position as possible using slight traction. Maintain traction until a splint is applied. Immobilize with two padded board splints, one placed on the inside of the leg, the other on the outside, and both secured with cravat bandages or a full-leg inflatable splint. Inflatable splints provide excellent immobilization, and will assist in bleeding control of compound fractures.

Treat the victim for shock and transport comfortably to the hospital.

ANKLE FRACTURES

CAUSE AND SYMPTOMS

The cause and symptoms of ankle fractures are similar to those of other fractures. It may be very difficult to distinguish a broken ankle from one that is sprained. Both will present swelling and pain and a marked disability.

EMERGENCY CARE

The ankle can be immobilized by using inflatable splints, board splints, or an improvised pillow splint.

A fracture-dislocation of the ankle with a marked deformity is a serious type of injury. To prevent damage to adjacent soft tissue, apply large dressings with slight pressure. A fracture-dislocation of the ankle should be immobilized in the position found. See Figure 22.

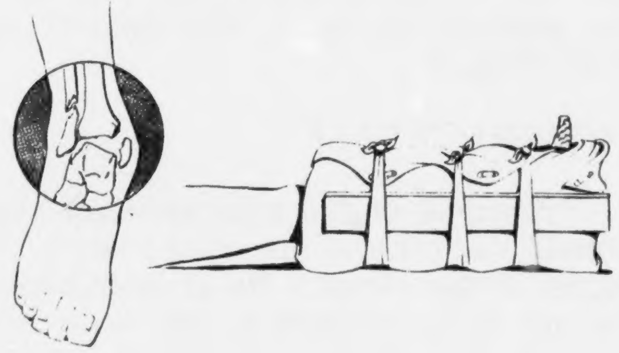


FIGURE 22. Pott's fracture and immobilization

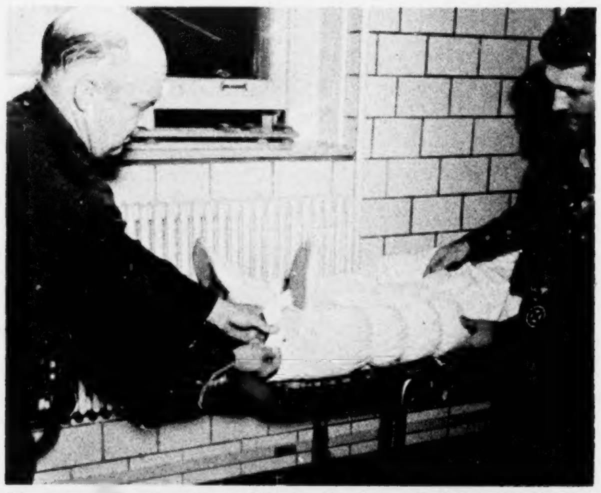
FOOT FRACTURES

CAUSE AND SYMPTOMS

The foot includes the small bones below the ankle as well as those of the toes. Such fractures are usually caused by heavy objects dropping on the foot. Pain, swelling, and tenderness will be indicated at the fracture site.

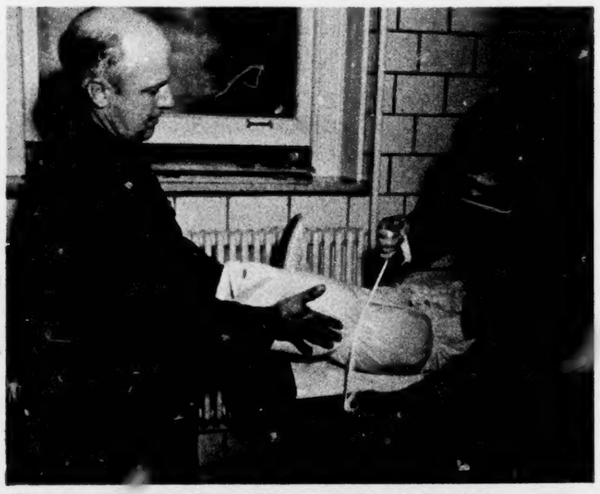
EMERGENCY CARE

If the fracture is not compounded, and if swelling is not too great, do not remove the shoe. The shoe left in place will provide adequate immobilization. If the decision has been made to remove the shoe, extreme care must be taken so as not to cause further injury. Keep the foot elevated, and immobilize with a pillow splint.



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

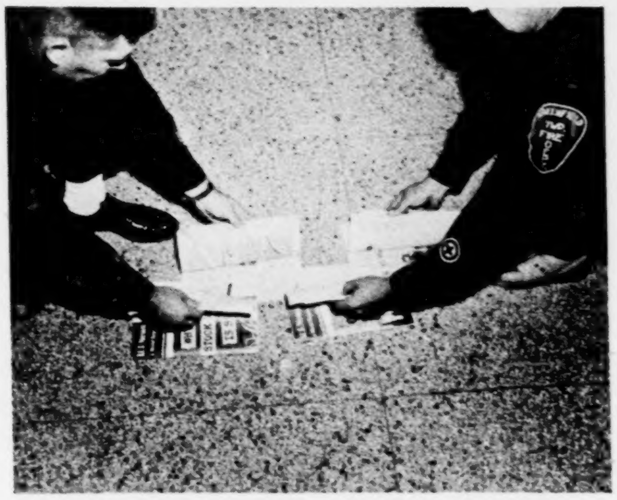
FIGURE 23



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

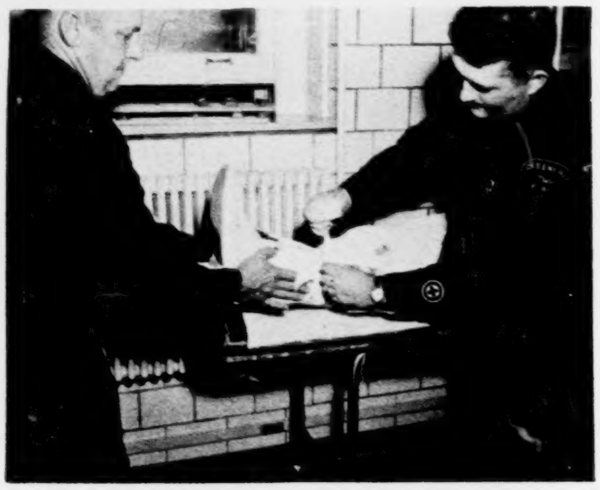
FIGURE 24

A splint can be improvised from household or squad pillows. Figure 23 shows one squadman supporting the victim's foot, while the other applies a two-inch roller bandage to secure the splint. After securing a pillow splint, the foot must be supported. Pinning the overlap of the pillow case, as shown in Figure 24 keeps the foot in an upright position and in the best alignment for transportation.



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

FIGURE 25



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

FIGURE 26

Improvised splints may be made from large magazines, interwoven as shown in Figure 25. An entire leg or arm could be immobilized this way and might require many magazines. Large magazines should be carried in all fracture kits. Figure 26 shows a magazine splint being applied. The knot is tied on one side, so as to make the splint as comfortable as possible for the victim. The splint runs above and below the joints adjacent to the fracture: in this case, the ankle and knee.

CHAPTER XIX

DISLOCATIONS

DEFINITION

A dislocation is a condition that occurs when the bones which form a joint slip away from each other beyond their normal positions. A dislocation is usually accompanied by tearing or stretching of ligaments, muscles and other soft tissue parts including blood vessels.

CAUSES

Dislocations are caused by falls or blows that apply a force in such a manner that the joint capsule is torn. The free-moving joints of the jaw, shoulder, elbow, wrist, fingers, hips, knee, ankle, and the toes are the joints most often dislocated.

GENERAL SIGNS AND SYMPTOMS

The major symptoms of dislocations are:

1. Pain, which may often be severe.

2. Deformity of a joint, with an obvious difference when compared with the unaffected joint.

3. Loss of motion, partially or completely locked.

4. Swelling, which usually occurs rapidly.

5. Discoloration.

6. Shortening or lengthening of an extremity.

EMERGENCY CARE IN GENERAL

Dislocations are best treated by supporting the dislocated area using slings, bandages, splints and other material that will immobilize and offer the greatest degree of comfort. No attempt should be made to straighten the part. It must be immobilized in line with the existing deformity. Treat for shock, for it is usually present in all dislocations. Transport to a hospital, avoiding any action that may aggravate the victim's condition.

The squadmen should make no attempt to reduce a dislocation. Improper manipulation can cause additional injury and damage to the ligaments, muscles, blood vessels and other soft tissues. However, if transportation to a medical facility will be delayed for an extended period, the squadmen then may attempt to reduce a dislocation only of the lower jaw.

SPECIFIC DISLOCATIONS

DISLOCATION OF THE LOWER JAW (MANDIBLE)

CAUSE AND SYMPTOMS

Dislocations of the jaw are caused by blows to the face or falls, or occasionally by laughing, yawning or chewing large bites of food. This dislocation is very painful. The mouth is open, the jaw is rigid and cannot be closed, and there is difficulty in talking. Usually both sides are dislocated.

EMERGENCY CARE

If transportation is to be delayed, reduction may be attempted as follows: Wrap both thumbs in several layers of cloth to protect them from injury. Place the protected thumbs in the victim's mouth, resting them on his lower back teeth, while the fingers grab the outside of the lower jaw. Press first downward, then backward. See Figure 1. As soon as the jaw starts to go into place, slip the thumbs off the teeth to the inside of the cheeks. The jaw will snap into place with a strong click and if the thumbs are on the teeth, they may be injured. If difficulty is experienced in reducing the dislocation, do not make repeated attempts.

After successful reduction, place the center of a cravat bandage over the front of the chin, and tie in back of the head, leaving the tails long. Have the victim open his mouth slightly, and place a small bandage compress or a padded tongue blade between the front teeth to keep the next cravat bandage from being placed too tight. Next take the second cravat, placing its center under the victim's chin and bring the ends to the center of the top of the head and tie, leaving the tails long. Bring the tails of both cravats together and tie them separately. Remove the bandage or tongue blade from between the victim's teeth.

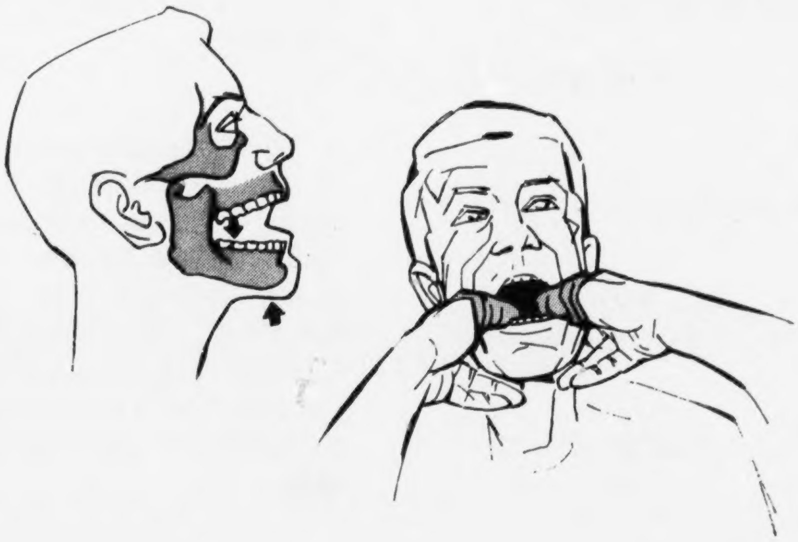


FIGURE 1. Reduce a dislocated jaw by grasping the lower jaw and pressing down and back with the thumbs protected.

DISLOCATION OF THE SHOULDER

CAUSE AND SYMPTOMS

The shoulder is usually dislocated by falls or blows on the shoulder or by falls on the hand or elbow. The arm is held rigid, the elbow will stand off one or two inches from the body, the shoulder appears flat and there is a depression beneath the point of the shoulder. Swelling will occur and pain is severe.

EMERGENCY CARE

Support the arm and place a pad about four inches wide and two or three inches thick beneath the arm, extending from the armpit to the elbow. Place the center of a cravat bandage on the outside of the arm just above the elbow. Carry both ends around the body and tie on the opposite side over a pad. Place the arm in a triangular bandage sling. Treat for shock.

DISLOCATION OF THE ELBOW

CAUSE AND SYMPTOMS

The elbow is dislocated as a result of a direct force or blow at the joint and occasionally by a fall on the hand. There is usually a marked deformity, great pain, and the victim is unable to bend his arm at the joint.

EMERGENCY CARE

Dislocations of the elbow may be found in many positions. Make no attempt to straighten the limb. Splint in the position found and pad it well to conform to the deformity. Due to severe pain, the treatment for shock may be indicated.

DISLOCATION OF THE WRIST

CAUSE AND SYMPTOMS

Dislocations of the wrist are not very common, but when they occur it is usually the result of the hand being extended to break a fall. It is difficult to distinguish between a dislocated and a fractured wrist.

EMERGENCY CARE

Treat this dislocation as a suspected fracture. Immobilize, pad all deformities, and transport.

DISLOCATION OF A FINGER OR TOE

CAUSE AND SYMPTOMS

The usual symptoms of a dislocated finger are shortening, deformity, pain, swelling, and the inability to bend the finger at the dislocated area.

EMERGENCY CARE

Attempts to reduce a dislocated finger or toe may be made, but it is recommended that the dislocation be protected with padding, splinted and supported in a comfortable position. Dislocations of the thumb may require surgical reduction due to its complicated structure; hence, no reduction should be attempted by the squadmen.

DISLOCATIONS OF THE HIP

CAUSE AND SYMPTOMS

Dislocations of the hip are the result of falls or force to the foot or knee, or by a direct blow to the thigh. Great force is required to cause a hip dislocation and fractures usually accompany this condition. There is severe pain, rigidity, loss of motion, and an obvious abnormal position of the leg. The hip may be dislocated in a forward or backward position, depending on the force directing the movement of the head of the thigh bone (femur). A backward dislocation is the most common with the foot turned inward and the thigh drawn toward the opposite leg. In a forward dislocation, the thigh is somewhat flexed and held outward, the foot is also turned outward.

EMERGENCY CARE

Logroll or carefully support and lift the victim onto a backboard. If the circumstances necessitate lifting, raise the victim only high enough to slide the backboard under him. Make a pad of blankets or other similar material large enough to support the leg in the line of the deformity. Immobilize by securing the victim to the board with straps or cravats. Keep the victim comfortable, reassure him and treat for shock. Transport very carefully to minimize movement and to prevent further aggravation. See Figure 2.

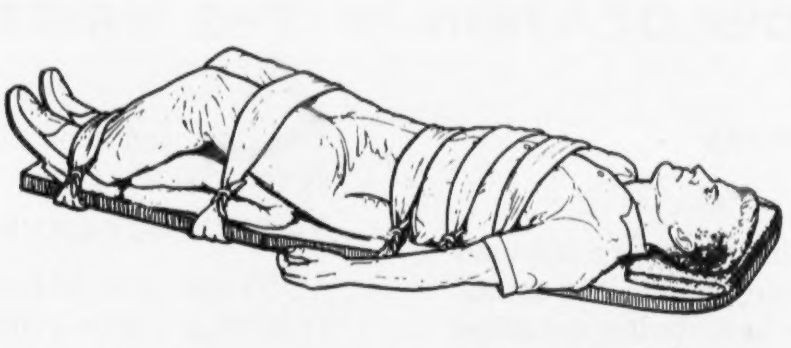


FIGURE 2. A method of immobilizing a dislocated hip

DISLOCATION OF THE KNEE OR KNEECAP

CAUSE AND SYMPTOMS

Dislocations of the knee or the kneecap result from direct force applied at the knee, or from a fall on the knee. There are signs of deformity, severe pain, and the inability to use the knee.

EMERGENCY CARE

While supporting the dislocation, apply a splint as for a fracture of the thigh, and pad to conform to the deformity.

DISLOCATION OF THE ANKLE

CAUSE AND SYMPTOMS

Dislocation of the ankle will show a marked deformity at the joint. Swelling is rapid. There is usually an accompanying fracture.

EMERGENCY CARE

Treatment will consist of supporting the dislocation and applying a splint as for a fracture of the ankle. Treat for shock and transport.

CHAPTER XX

WOUNDS AND BANDAGING

WOUNDS

A wound is any injury in which there is a break in the skin or in the lining of the body's cavity.

Regardless of the type of accident, there are only certain types of wounds that can be produced. Emergency medical personnel must be able to recognize the different types of wounds if they are to administer proper care.

All open wounds present two major problems, infection and bleeding. Infection must be considered a possibility no matter how small the injury may appear. Excessive bleeding can be dangerous and must be controlled as soon as possible. (See Chapter XIII, Page 131.)

TYPES OF WOUNDS

Open wounds are classified according to the following types: abrasions, incised, lacerated, and punctured. See Figure 1.

Abrasions: These are wounds caused by a scraping of the skin, sometimes referred to as "brush-burns," or "friction-burns." There usually is little bleeding and the abrasion frequently contains particles of foreign matter such as cinders, grease, or dirt. Since large areas of the skin are scraped off, the wound may be painful.

Emergency Care: The entire area must be covered with a sterile dressing. This can be held in place with adhesive tape, or, if the area is large, secure the dressing with a snug bandage.

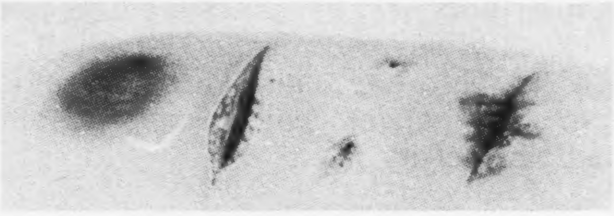


FIGURE 1. Kinds of wounds. From left to right: Contused, incised, punctured, lacerated

Incised Wounds: Incised wounds are caused by any sharp cutting object, such as a knife, razor, glass, or sharp metal. The blood vessels and tissue are severed with what is usually referred to as a "clean cut," leaving a smooth-edged, free-bleeding wound that may produce sharp stinging pain. The chief dangers are severe bleeding and damage to nerves and tendons.

Emergency Care: The wound edges may be drawn together and secured with "butterfly strips." These can be made from tape, improvised from small "band-aids," or purchased commercially. Apply a sterile pressure dressing and treat for shock.

Lacerated Wounds: Lacerated wounds are jagged with irregular edges and are caused by blunt instruments, stones, machinery, or direct blows. These wounds bleed very little and vary in depth and shape. Parts of skin and tissue may be partly or completely torn away. Lacerations contain much foreign matter such as street dirt, grease, bits of clothing, glass, etc. In accidents caused by machinery, body parts may be crushed and bleeding freely. All severe wounds of this type will produce shock, and, in extreme cases, may prove fatal.

Emergency Care: Control the bleeding and protect the wound by covering with a thick sterile pressure dressing. In cases of severe injuries, immobilization of the part may be necessary. Treat for shock and transport to a medical facility.

Puncture Wounds: A puncture wound is a perforation of the skin and tissues caused by nails, stabs, gun shots, or any sharp object capable of penetrating the skin. Although the opening in the skin may be small, they usually are very deep and prove to be serious. Contaminating foreign matter is often carried into the wound. The penetrating object may break, leaving a piece in the tissues; parts of clothing may be pushed into the wound. The dangers of this type of wound are injury to internal organs and infection.

A gun shot wound may cause deep internal bleeding with damage to vital organs. The points of entry and exit of a bullet must receive equal attention. If the bullet has entered the chest and abdomen, the care will be as indicated for chest and abdominal injuries in Chapter XXI, Page 223.

Emergency Care: Penetrating objects must not be removed, but should be immobilized and supported. Cover the wound with a sterile dressing, treat for shock, and transport to a medical facility. Tetanus immunization for this victim must be checked by the attending physician.

AVULSIONS (SEVERED BODY PARTS)

Whenever a portion of the body is completely severed or torn away (usually extremities, but may also be an ear, etc.), immediate bleeding control must be applied and the injury site protected with a proper pressure dressing. Treat for shock and remember that the severed part must accompany the victim to the medical facility. Wrap the severed part in a clean cloth and keep it out of sight of the victim.

DRESSINGS AND BANDAGES

Dressings should not be confused with bandages since a bandage represents the outside covering of a dressing. A dressing is a sterile covering applied to a wound or to an injured part to:

1. Assist in the control of bleeding.

2. Protect a wound from further injury.

3. Prevent the introduction of bacteria.

Dressings are fixed in position over a wound either with a bandage or tape.

Dressings in use range from the 2" x 2" - 3" x 3" - 4" x 4" gauze pads to the 10" x 30" universal dressing. Bandage compresses that have a dressing sewn to a length of bandage, ranging in sizes of 1" x 1" to 4" x 4", and packaged in individual sterile units are used quite frequently.

Bandages are used to hold dressings in place, to secure splints, to create pressure, and to immobilize and support body parts. The most frequently used types of bandages are roller bandages; triangular bandages; four-tailed bandages; and many-tailed (scultetus binder) bandages.

The roller bandage has improved over the years to the recent development of the "soft-self adhering" bandage that is popular with most emergency medical personnel.

Bandages should be applied tightly enough to control bleeding and prevent the dressing from moving, but not so tightly as to interfere with circulation. Therefore, elastic bandages are not recommended. To eliminate the possible danger of injurious pressure if improperly applied, elastic bandages should be replaced with the soft roller-type bandages.

The squadman should be familiar with the general application of the various types of bandages. The comfort of the victim and the security of the dressing depend upon the proper application of a bandage. An untidy, uncomfortable, insecure bandage can only result in adverse criticism.

TRIANGULAR BANDAGE FOR THE HEAD

When using the triangular bandage to retain dressings on forehead or scalp, the following procedure should be followed:

Fold back the base of the bandage about 2 inches making a hem. Place the middle of the base (hem outside) on the forehead just above the eyebrows. Let the point fall over the head and down the back of the head. Bring the ends of the triangle around the back of the head above the ears, cross them over at the back and carry them around to the forehead, tying them in a square knot. Holding the dressing with one hand, gently but firmly pull down on the point with the other hand until the dressing is snug; then bring the point up and tuck it over and in the bandage where it crosses at the back of the head. See Figure 2.

TRIANGULAR BANDAGE FOR THE SHOULDER

When using the triangular bandage to hold a dressing on the upper arm or shoulder, two triangular bandages are necessary:

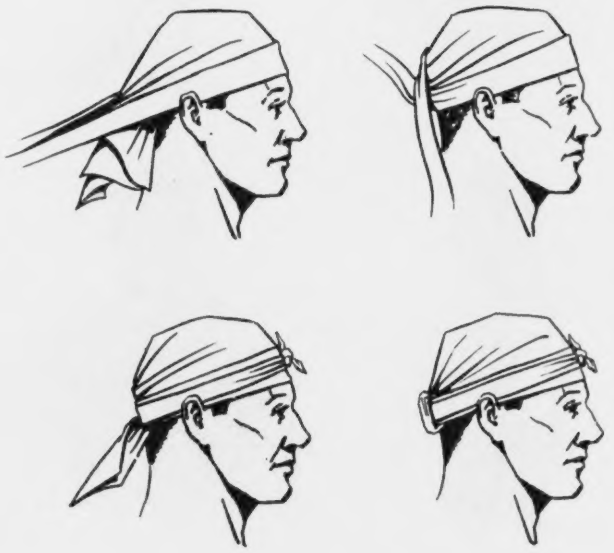


FIGURE 2. Triangular bandage for head

Fold the first triangular bandage into a narrow cravat (see Figure 3). Place the base of the cravat on top of shoulder on injured side and bring ends across back and chest. Continue, bringing cravat under opposite armpit around in front. Before tying knot, place a pad in the armpit on the uninjured side to prevent pressure by the narrow cravat. Then tie a square knot. Turn up the base and make a hem of the second triangular bandage and apply it to the arm on the injured side. Carry the ends around behind the arm; cross and tie them in front but not too tightly. Check circulation frequently to be sure a tourniquet effect has not been inadvertently created. Support the dressings firmly with one hand, and with the other tuck the point of this triangle under and over the cravat on the shoulder until the dressings are held snugly in place. Pin the point to secure it, or bring the point of the bandage under and around the cravat several times to secure it.

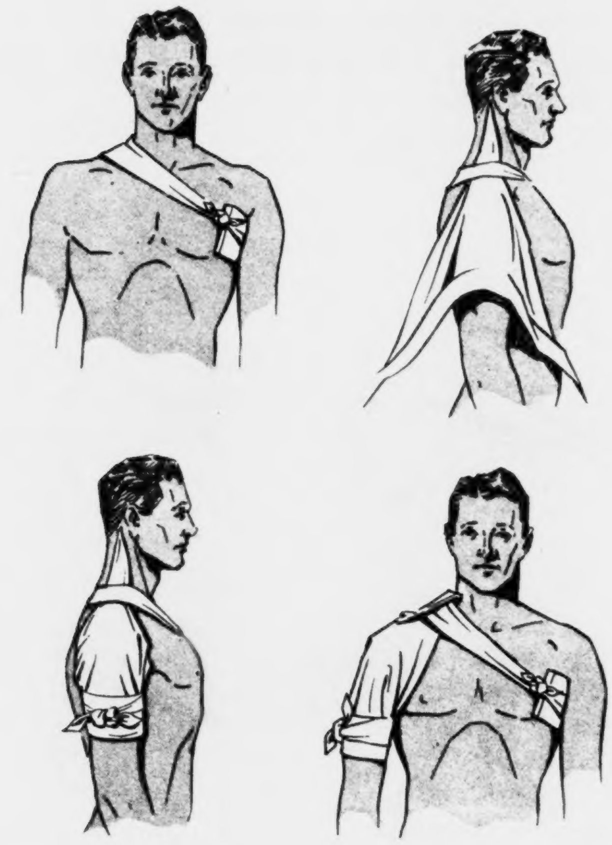


FIGURE 3. Triangular bandage for shoulder

TRIANGULAR BANDAGE FOR THE HIP

The triangular bandage may also be used to retain dressings on buttock or hip:

This requires two triangular bandages. Take the first and make into a narrow cravat; tie it around the waist with the knot on the uninjured side. Take the second triangular bandage and tuck the point under and over the cravat, letting the base hang down over the thigh on the injured side. Make a hem along its base to the height desired, carry the ends around the thigh, cross, bring around to outside, and tie. With the left hand, hold the dressing in place and gently pull the point hooked through the waist cravat until the dressing is well supported. To secure the point, use a safety pin or tuck under. See Figure 4.

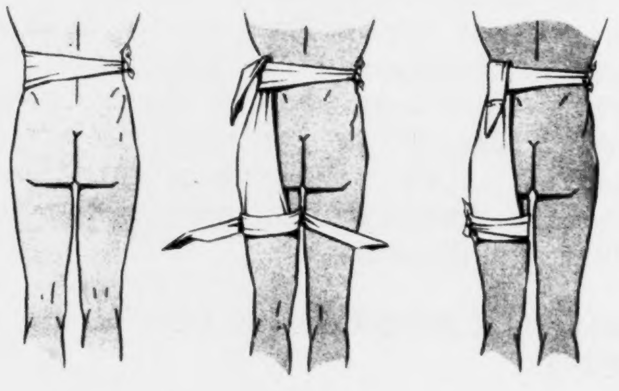


FIGURE 4. Triangular bandage for hip

TRIANGULAR BANDAGE FOR THE FOOT OR HAND

This bandage is designed to retain large dressings of the hand or foot:

Place the foot or hand in the center of a triangular bandage and carry the point over the ends of the toes or fingers and on up to the upper part of the ankle or wrist. Fold in excess bandage at the sides, cross the ends in front, continue around back, cross, bring around to front, and tie in a square knot. See Figure 5.

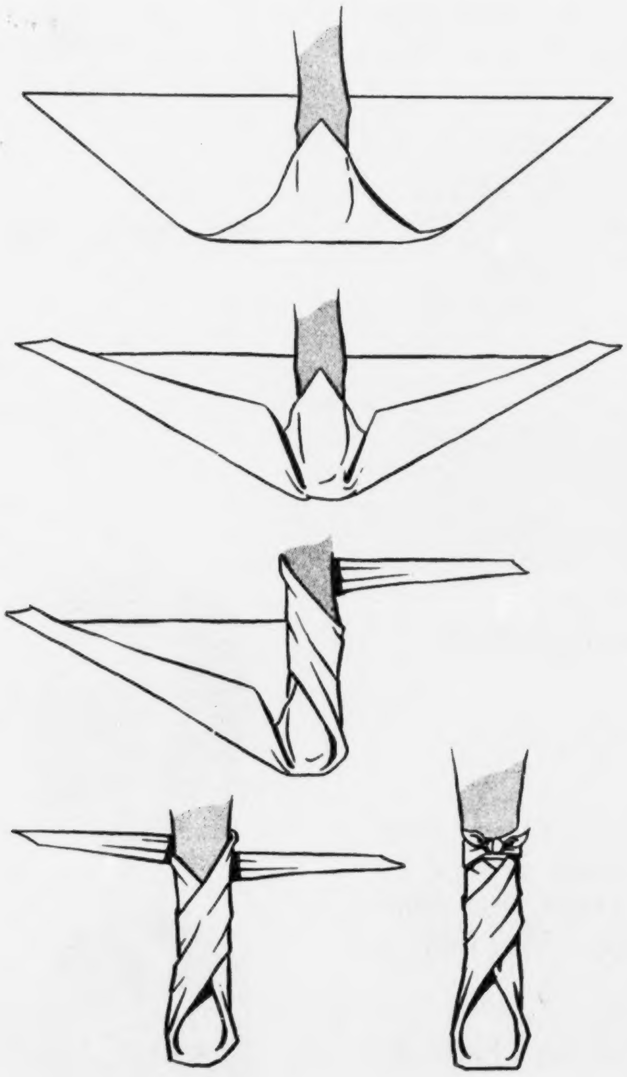


FIGURE 5. Triangular bandage for foot or hand

THE CRAVAT BANDAGE

To make a cravat bandage, bring the point of a triangular bandage to the middle of the base and continue folding until the desired width is obtained. See Figure 6.

CRAVAT BANDAGE FOR THE HEAD

This bandage is very useful to control bleeding from wounds of the scalp or forehead. It is placed over the dressing as follows:

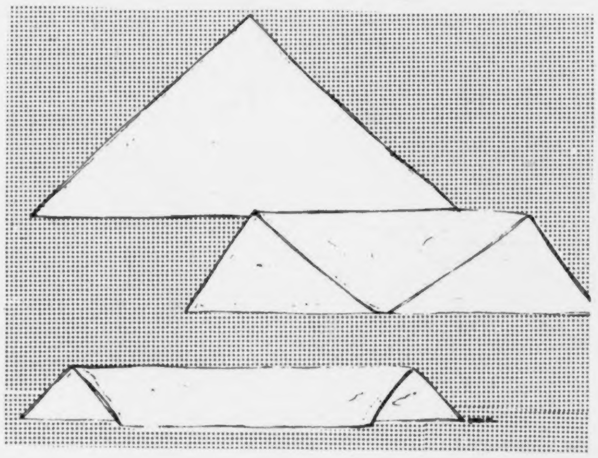


FIGURE 6. Making a cravat bandage

Place the center of the cravat over the dressing, bring the ends around to the opposite side, cross them, and continue around to the front. Tie with a square knot. See Figure 7.

CRAVAT BANDAGE FOR THE TEMPLE, CHEEK, OR EAR

Place the center of the cravat over the dressing and carry one end over the top of the head and the other under the jaw and up the opposite side, crossing at right angles over the temple on the injured side. Continue one end around, over the forehead, and the other around the back of the head to meet over the temple on the uninjured side. Tie with a square knot. See Figure 8.

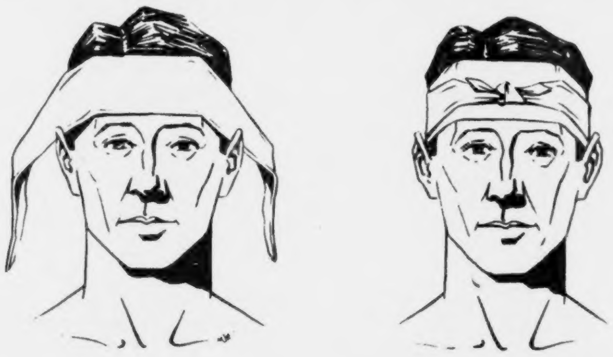


FIGURE 7. Cravat bandage for head

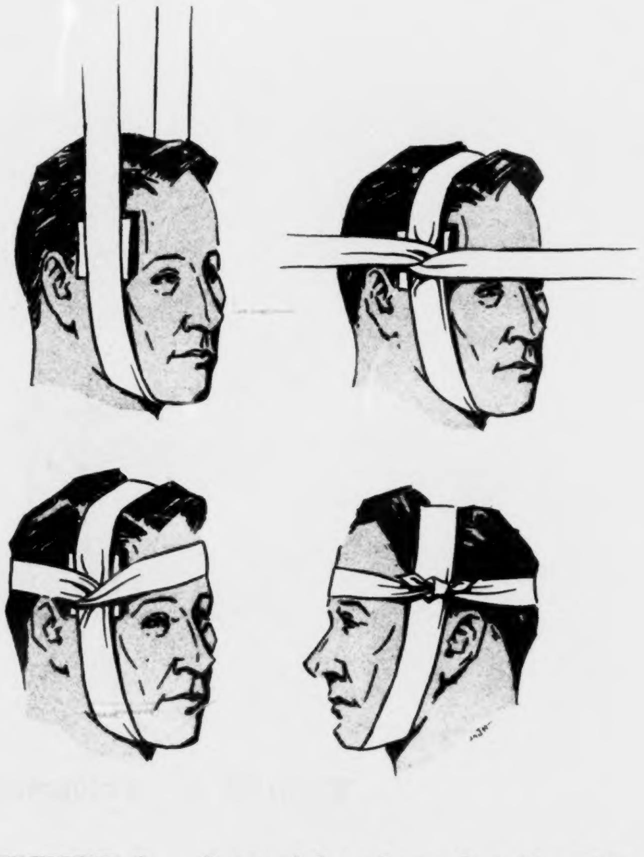


FIGURE 8. Cravat bandage for temple, cheek, or ear

CRAVAT BANDAGE FOR THE ELBOW OR KNEE

When applying a bandage to the elbow or knee, the joint should be flexed in order to allow a certain amount of movement. Bend the knee or elbow at the angle shown in Figures 9 and 10. Place the middle of a rather wide cravat over the point of the joint, carrying one end around the upper part of the elbow or knee, bringing it back to the hollow, and the other end entirely around the lower part, bringing it back to the hollow. See that the bandage is smooth and snug; tie with a knot outside the hollow.

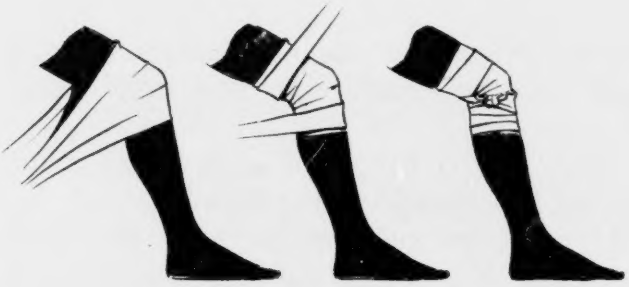


FIGURE 9. Cravat bandage for knee

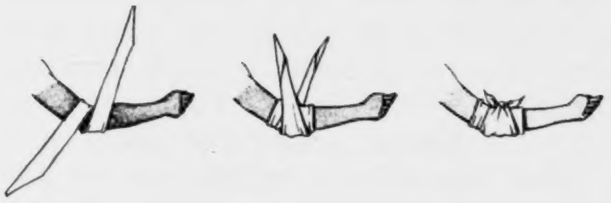


FIGURE 10. Cravat bandage for elbow

CRAVAT BANDAGE FOR THE ARM, FOREARM, LEG, OR THIGH

The width of the cravat depends upon the extent of injury and size of the dressing covering it. For a small area, place the cravat bandage over the center of the dressing. Bring the ends around in back, cross them, bring back around to the dressing, and tie over it. For a small extremity, it may be necessary to make several turns before tying. If the wound covers a larger area, hold one end of the bandage above the dressing and wind the other end spirally downward across the dressing until it is secure, then upward and around again, and tie a knot where both ends meet. See Figure 11.

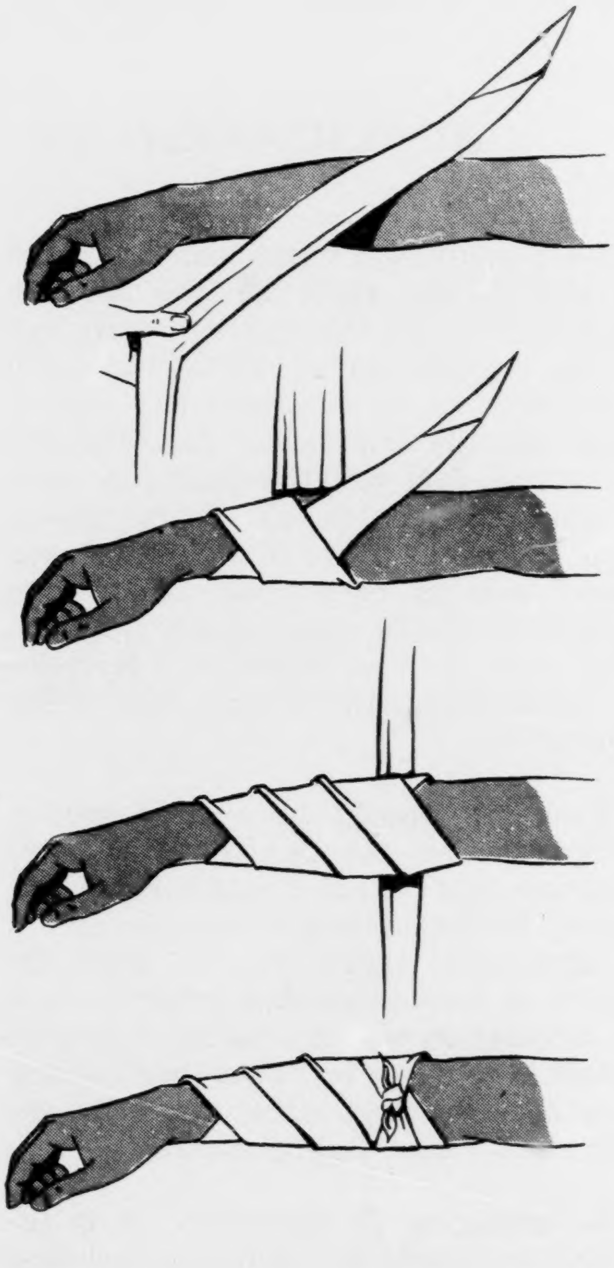


FIGURE 11. Cravat bandage for arm, forearm, leg, or thigh

CRAVAT BANDAGE FOR THE ARMPIT

Place the center of the bandage in the armpit over the dressing, carry the ends up over the top of the shoulder and cross them. Continue slantwise across the back with one end and across the chest with the other, over the opposite armpit, and tie them where they meet over the chest. Do not draw the bandage too tightly or the artery may be compressed, adversely affecting circulation to the arm. See Figure 12.

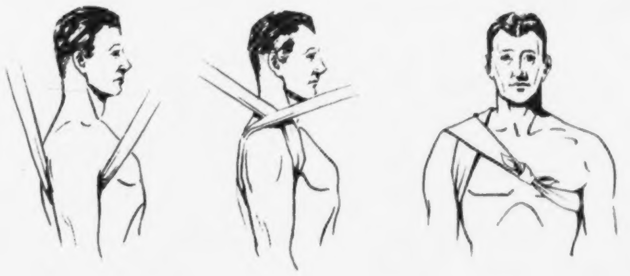


FIGURE 12. Cravat bandage for armpit

APPLICATION OF A ROLLER BANDAGE

When applying a roller bandage, hold the roll in the right hand so that the loose end is on the bottom; next, apply the outside surface of the loose end to the area to be bandaged and hold it there with the left hand. Pass the roll around the part with the right hand, and control the tension as it is passed around. Two or three of the initial turns should overlap each other in order to secure the bandage and keep it in place. When turning the bandage, transfer the roller from hand to hand, facilitating application.

Bandages should be applied evenly, firmly, but not too tightly. Excessive pressure may interfer with circulation, leading to disastrous consequences. It is advisable, therefore, to leave the fingers or toes exposed in order to check the circulation of these parts. It is also advisable to use a large number of turns to secure a bandage rather than to depend upon a few turns, tightly applied.

In bandaging an extremity, it is advisable to include the whole member (arm and hand, leg and foot), excepting fingers and toes. So doing maintains uniform pressure throughout the limb and still allows one to check circulation to the limb by pressure on the nail beds.

The initial turns of a bandage on an extremity should be placed (if at all possible) around the part of the limb that has the smallest circumference. Thus, around the wrist or immediately above the ankle is the site for the start of the bandage; and the final turns should be secured in the same manner as the initial ones, i.e., by two or more overlying circular turns which are then folded over to present a neat, cufflike appearance. The end of the completed bandage is turned under and secured to the final turns by a safety pin or adhesive tape. If these are not available, the end of the bandage may be split lengthwise for several inches, and the two tails tied to secure the bandage.

ROLLER BANDAGE FOR THE HAND AND WRIST

A figure-of-eight bandage is ideal for this area and may be applied as follows:

Anchor the dressing with several turns of a 2- or 3-inch bandage. If the hand must be bandaged, anchor the dressing with several turns and continue the bandage diagonally upward and around the wrist and back over the palm. Make as many turns as necessary to secure the dressing. See Figure 13.

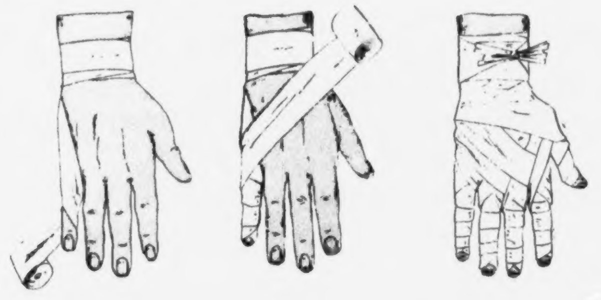


FIGURE 13. Roller bandage for hand and wrist

ROLLER BANDAGE FOR THE ANKLE AND FOOT

The figure-of-eight bandage is also used for dressings of the ankle as well as for supporting a sprain:

Keep the foot at a right angle; start a 3-inch bandage around the instep for several turns to anchor it. Bring the bandage up over the instep, around behind the ankle, forward again across the instep and down under the arch, thus completing one figure-of-eight. Continue with the figure-of-eights, overlapping one-third to one-half of the bandage's width. Occasionally turn around the ankle. Make as many turns as necessary to secure the dressing adequately or until adequate support is obtained. See Figure 14.

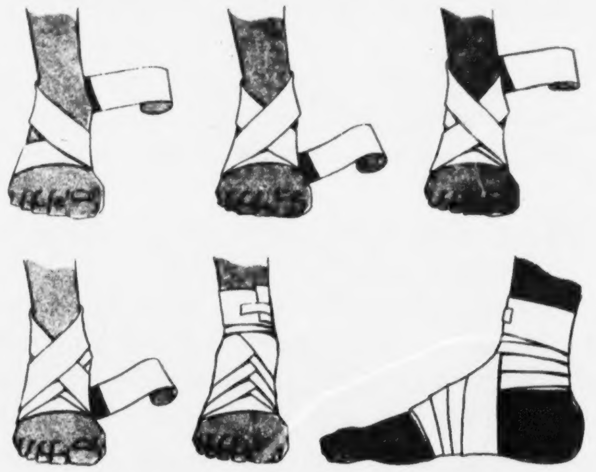


FIGURE 14. Roller bandage for ankle and foot

ROLLER BANDAGE FOR THE KNEE

The figure-of-eight bandage of the knee is similar to that of the elbow:

Make two circular turns around the thigh just above the knee and bring the bandage diagonally downward across the kneecap and encircle the leg below the knee with another circular turn. Bring the bandage diagonally upward, again crossing the kneecap to the basic anchor turn. Make another circular turn and repeat the figure-of-eight procedure, overlapping each previous turn about two-thirds of the width of the bandage gradually ascending the knee. Secure the bandage with several circular turns above the knee and tie. To secure the dressings in the hollow of the knee, reverse the procedure and cross the bandage in the back. See Figure 15.

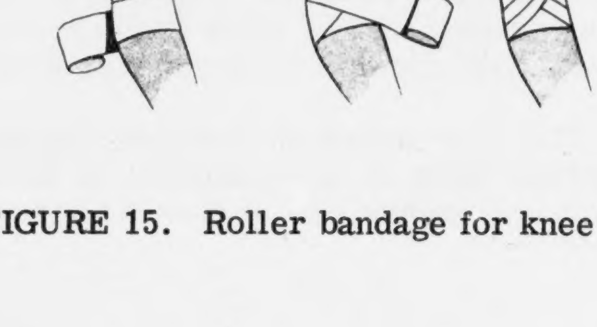


FIGURE 15. Roller bandage for knee

ROLLER BANDAGE FOR THE HEEL

The heel is a very difficult part to bandage securely. Keep the foot at right angles and use the following method:

Place the free end of the bandage on the outer part of the ankle and bring the bandage under the foot and over the instep. Continue around the heel and back over the instep to the starting point. Overlap the lower border of the first loop around the heel and then repeat--the turn overlapping the upper border of the loop around the heel. Continue with these turns until the heel is well covered and then secure the end with several turns around the lower leg. See Figure 16.

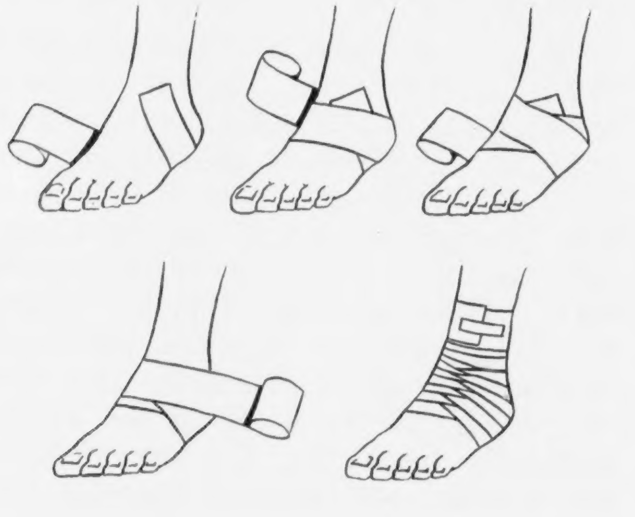


FIGURE 16. Roller bandage for heel

ROLLER BANDAGE FOR THE ELBOW

A figure-of-eight type of bandage is recommended to retain dressings in the elbow region and to allow some movement. The elbow is bandaged as follows:

Flex the casualty's forearm slightly (without force if he complains of much pain) and anchor a 2- or 3-inch bandage above the elbow with two circular turns. Bring the bandage diagonally downward across the hollow of the elbow and encircle the forearm below the elbow. Continue diagonally upward across the hollow of the elbow to the starting point. Make another circular turn around the upper arm, bring the bandage downward, repeating the figure-of-eight procedure, and gradually ascending the arm. Overlap each previous turn about two-thirds of the width of the bandage. Secure the bandage with two circular turns above the elbow and secure. If it is necessary to secure a dressing on the tip of the elbow--reverse the procedure and cross the bandage in the back of the arm. See Figure 17.

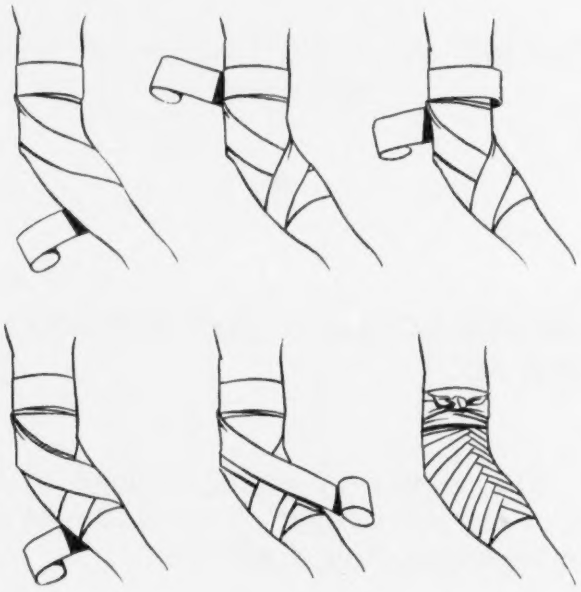


FIGURE 17. Roller bandage for elbow

ROLLER BANDAGE FOR THE FOREARM, LEG AND THIGH

The spiral reverse bandage must be used to cover dressings on these parts--only such a bandage can keep the bandage flat and even.

Make two or three circular turns around the lower or smaller part of the limb to anchor the bandage, and start upward. Bring the bandage diagonally around the arm, overlapping about one-third to one-half of the width of the bandage, and continue wrapping as long as each turn lies flat. When the edge of a turn is loose, it is necessary to use the reverse lap. Afterward, continue with the spiral lap making reverse laps only when necessary to maintain a flat, even bandage. Secure the end with several circular turns and adhesive, safety pin, or split tie. See Figure 18.

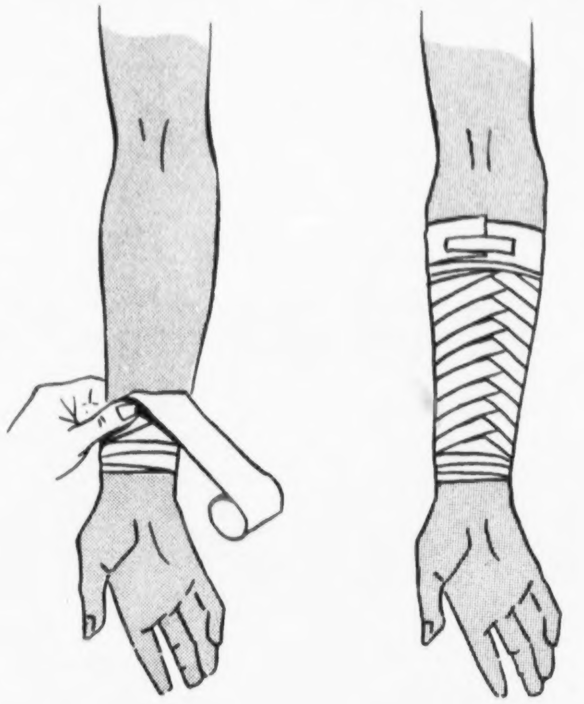


FIGURE 18. Roller bandage for forearm, leg and thigh

ROLLER BANDAGE FOR THE HEAD

First a gauze pad is placed over the lacerated area in the scalp; then, the bandage (generally of 2-inch gauze) is wound in accordance with the numbered rolls shown in Figure 19.

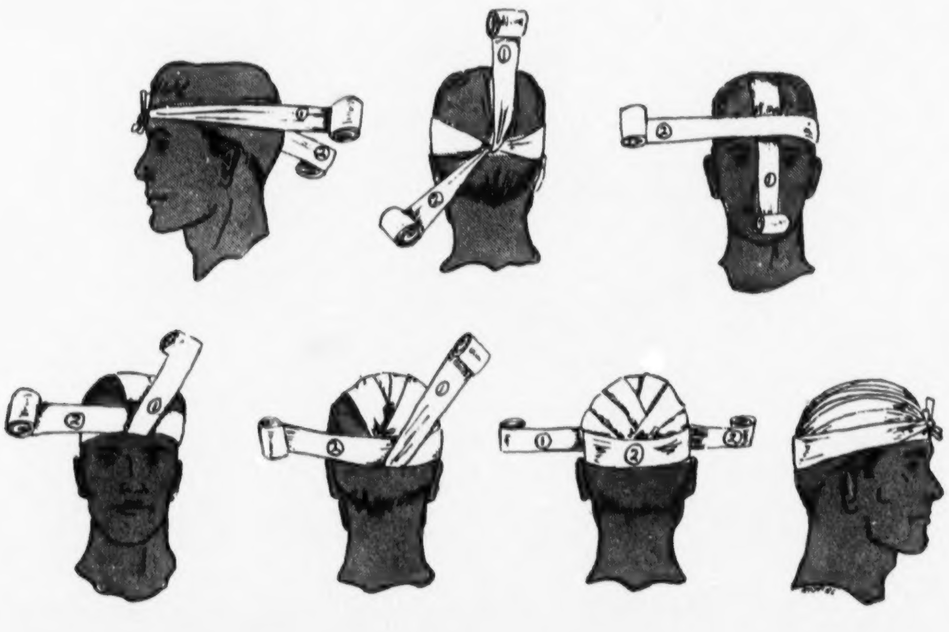


FIGURE 19. Roller bandage for head

CHAPTER XXI

INJURIES OF THE EYE, EAR, NOSE, CHEST, ABDOMEN AND GENITALIA

EYE INJURIES

Unless the injury to the eye is a minor one, the best advice to all squadmen would be to refrain from interfering with it. Eye injuries are more serious than similar injuries to other tissues because of the ever present danger of vision loss. A minor injury improperly cared for can progress into one that may be serious, and a penetrating wound may result in blindness.

The most frequently occurring injuries result from foreign bodies lodging or embedding in the eye tissues. But under certain emergency conditions, injuries may range from trauma to the eyelids, hemorrhage into the cavity of the eye, laceration of the eyeball, to the possibility of removal of the entire globe.

Without special training, interference may lead to disaster. Emergency care is, therefore, conservative and directed toward bringing the victim into the hands of a specialist at the earliest time and in the best physical condition.

EXAMINATION

No time consuming examination should be made to determine the extent of injury. A simple visual examination should be sufficient to alert the squadman, and this simple examination should be accomplished without exerting any pressure on the eyeball. Remember that even the slightest pressure may cause the loss of part or all of the vital fluids in the eye.

A penetrating wound should always be suspected until it has been ruled out by a physician. Some obvious signs of penetrating wounds are: (1) visible defects or damage of the eyeball, (2) visible foreign bodies or protruding objects, and (3) loss of the eye fluids (vitreous humor, aqueous humor).

EMERGENCY CARE--FOREIGN OBJECTS

Sometimes a foreign body under the upper lid may be removed by drawing the upper lid down over the lower lid; as the upper lid returns to its normal position, its under surface will be drawn over the lashes of the lower lid and the foreign body removed by the wiping action.

Another method is to expose the under surface by grasping the eyelashes between the thumb and forefinger of one hand and turning the lid up over the end of a match stick or applicator stick; the particle may then be removed carefully with a corner of a piece of folder sterile gauze. See Figure 1.

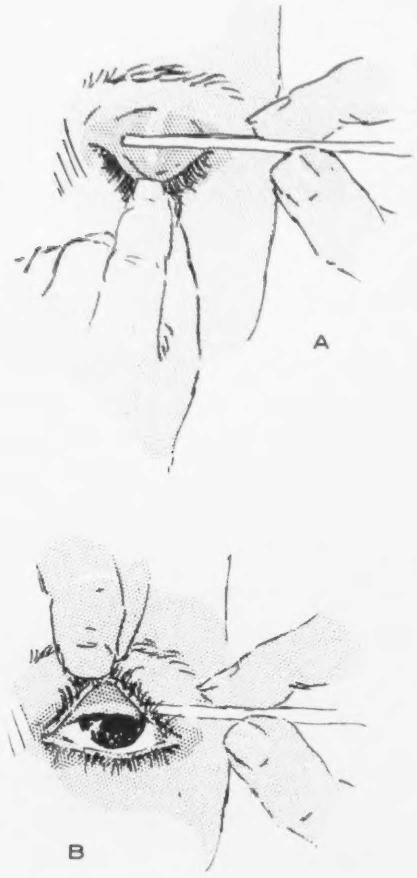


FIGURE 1. Technique of rolling the eyelid. A, Depress the upper lid with an applicator stick and grasp lash between thumb and index finger; B, Roll the lid by lifting it up over the applicator stick.

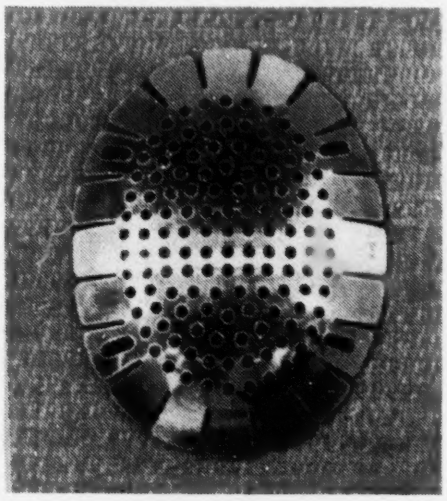


FIGURE 2. A metal eye-shield, used to protect an injured eyeball

Should a foreign object become lodged on the eyeball, do not attempt to disturb it, as it may be forced into the eye and cause a serious condition. Place a metal eye-shield over the eye (Figure 2) and transport.

EMERGENCY CARE--PENETRATING OBJECTS

Penetrating wounds of the eye include any injury that may cut or penetrate the eyeball. The following procedures must be carried out:

1. If there is an object penetrating the eyeball, do not remove it.

2. If the object is protruding from the eye, support it by wrapping and tying bandages carefully.

3. If there is no object protruding, or if the embedded object is not extending beyond the eye, cover it with a metal eye shield (Figure 3). Do not put compresses or other gauze dressings on the injured eye; they may cause harmful pressures, and may absorb the vital fluids of the eye.

4. Cover both eyes. This will immobilize and keep the eyes at rest.

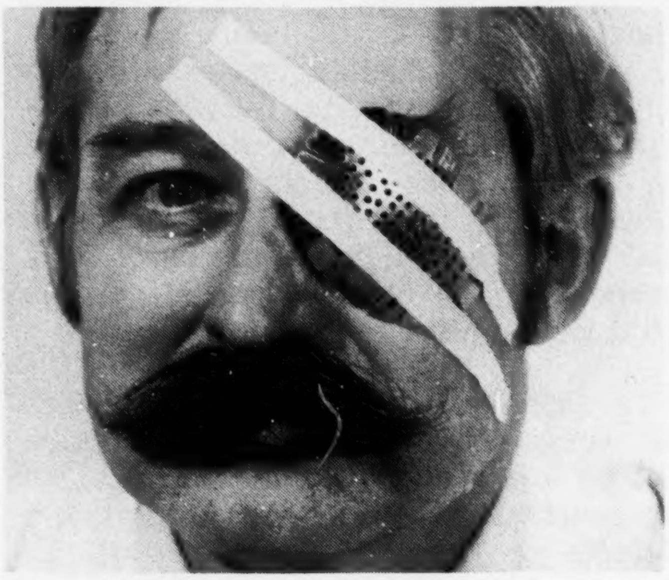


FIGURE 3. The proper application of a metal eye-shield

5. Keep the victim on his back. This will help to keep the fluids from draining from the injured eye.

6. Reassure the victim; explain what you are doing and why you are covering both eyes.

EMERGENCY CARE--BLOWS TO THE EYE AND SURROUNDING TISSUE

Injuries resulting from blows to the eye and eye area causing the common "black eye" can be very serious. If there is any evidence of internal bleeding, change in vision, or damage to the iris, lens, or retina, special care is indicated and the victim must be transported to the proper medical facility. Any injury that is so severe as to cause internal bleeding may progress to a condition referred to as secondary hemorrhage and cause a detachment of the retina.

Place a metal eye shield over the injured eye; cover both eyes to immobilize them and transport.

If the injury has torn or split the eyelid, moistening of the cornea becomes a problem. The cornea should never be allowed to become dry; coarse gauze dressing should never be applied over the unprotected area. Careful bandaging will be necessary to be sure that the mucous membrane covers the cornea.

EMERGENCY CARE--BURNS

Acid Burns: As a rule acid burns are instantaneous. The extent of the burn depends upon the strength of the acid and the duration of exposure to the eye tissue. Immediate treatment of acid burns requires flushing and washing the eye with large amounts of water. Sterile water is preferred but the washing can be carried out with ordinary tap water for speed is of great importance. The eyes should be flushed for at least 15 to 30 minutes depending upon the quantity of acid; special attention must be paid to flushing under both eyelids. This flushing procedure can be carried out during transportation and not cause any unnecessary delay in bringing the victim and proper medical care together in the shortest time.

Alkali Burns: Unlike acid burns, alkali has a tendency to "burrow" into the eye tissue. Immediate flushing with large amounts of water is the best emergency treatment, and flushing must continue for from 30 to 45 minutes and every bit of alkali must be removed. Attention must be given to the eyelids; lift them and flush. See Figure 4.

Thermal Burns: Because of the normal blink reflex, thermal burns of the eye are usually limited to the eyelids. Minor burns are best treated by first closing the lids and then applying a loose soft dressing.

If the burns are severe, in all likelihood there will also be severe burns about the face and body. Shock may complicate the situation and demand the initial treatment. After starting the treatment the eyes must be flushed to remove any foreign material that is not imbedded. Molten metals, metallic sparks, cinders, etc., can cause severe burns that require professional care as soon as possible.

Since dressings tend to increase the possibility of infection and prevent draining of secretions, the eyes should be left open.

Flash Burns: Exposure to ultraviolet rays may burn the cornea as can happen to those looking at carbon arcs and welders' arcs without protective glasses. Burns of this type may also be caused from long exposure to the brilliant

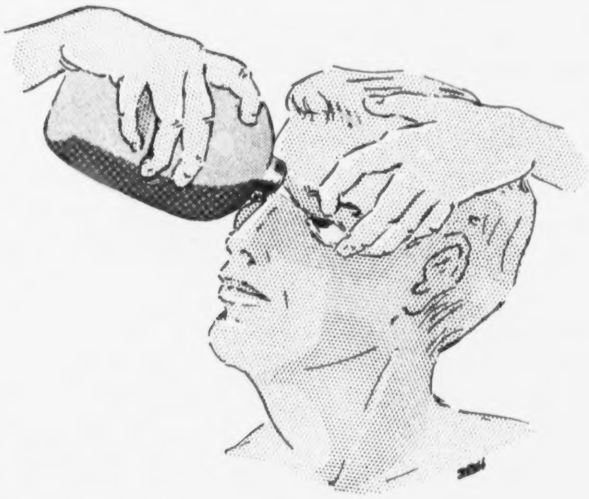


FIGURE 4. Technique of flushing the eyes

light of sun covered snow fields and open water. The first symptoms are scratchiness and flowing of tears, followed by painful sensitivity to light. Bandage both eyes loosely and transport. Ice packs or cold compresses may provide some comfort to the victim.

CONTACT LENSES--CARE FOR THE INJURED

Contact lenses are designed to be worn while awake. If a person is injured due to accident, sickness or other causes, the lenses should be removed. If the injured person is unconscious or unable to remove his lenses, and if professional help is not available, these instructions should be followed:

1. Determine the type of lens. There are two main types of contact lenses. The most widely used are:

a. Small corneal lenses of a diameter less than the colored part of the eye (smaller than a dime).

b. A few persons wear the larger scleral lenses (about the size of a quarter), which cover all of the colored part of the eye and some of the white of the eye.

2. When not to remove. If the colored part of the eye is not visible upon opening the eyelids, it is best to await the arrival of an optometrist or ophthalmologist.

3. How to remove the lens. It is acceptable to remove the lens with the patient on his back. In all instances be gentle. Force can cause more harm than the effect from the lens on the eye. If any difficulty is encountered, obtain and await services of a physician.

a. Corneal lens: With clean hands, lightly place thumbs from the side, close to the edge, and parallel with the upper and lower eyelids. Open the lids gently and observe if the lens can be seen. If it is not on the colored part of the eye, there is less concern; wait for an experienced practitioner. If the lens is visible, it should slide with the movement of the eyelids with thumbs still at the very edge of the eyelids. Gently position the eyelids slightly wider than the edge of the lens, maintaining this opening. Press GENTLY straight upon the eye. This should cause the lens to tip up on one edge. Upon observing this, slide the eyelids and thumbs together; the lens should slide out between the lids where it can be taken off. Remember, all of this is done gently. Force should not and must not be used. If the lens is seen but cannot be removed, gently slide it to the white part of the eye where it can remain safely until experienced help is available. (A commerically available "suction cup" type lense remover is shown in Figure 5.)

b. Scleral lens: With clean hands, place one finger parallel with and at the edge of the lower eyelid. Carefully press the lid back under the eye until the edge of the lens becomes visible. Maintaining the pressure, slide the finger toward the victim's ear, pulling the eyelid taut. This should cause the lid to slide under the lens, lifting the edge so that it may be grasped for removal. This requires more pressure than for the smaller lenses, but avoid force.

c. If the lenses are found or removed, place in a case or bottle and label ("right" and "left," if known) with the victim's name.

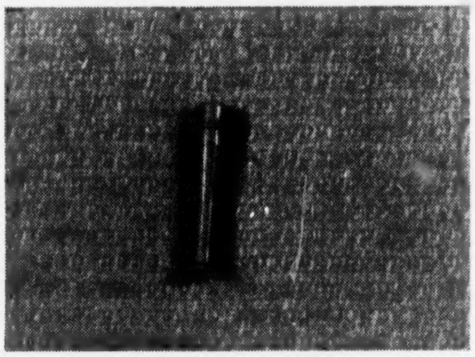


FIGURE 5. The "Suction-Cup" type contact lense remover

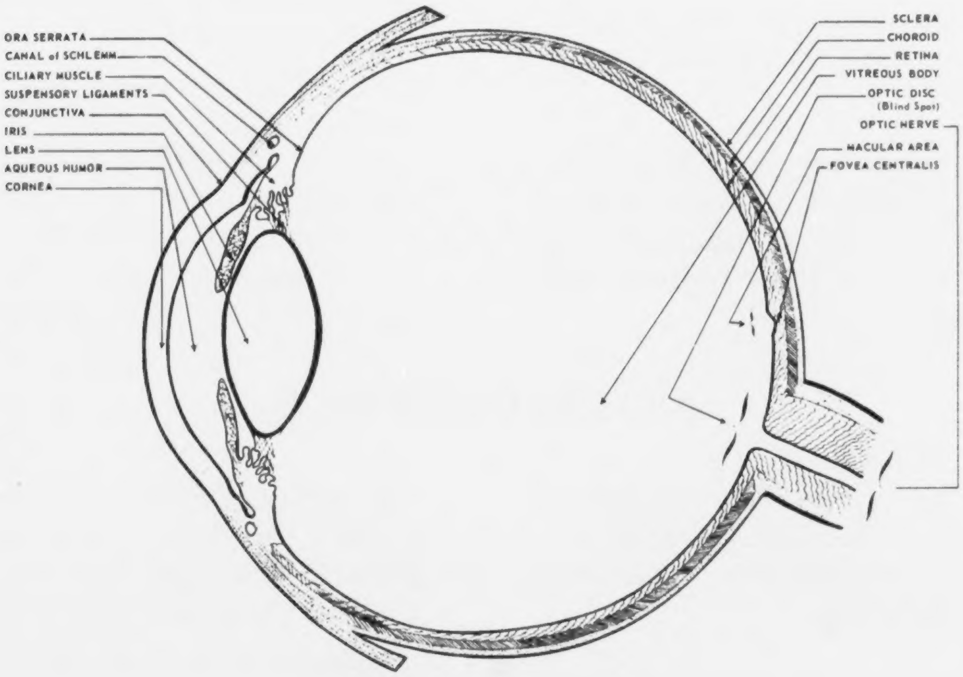

ORA SERRATA
CANAL of SCHLEMM
CILIARY MUSCLE
SUSPENSORY LIGAMENTS
CONJUNCTIVA
IRIS
LENS
AQUEOUS HUMOR
CORNEA
SCLERA
CHOROID
RETINA
VITREOUS BODY
OPTIC DISC
(Blind Spot)
OPTIC NERVE
MACULAR AREA
FOVEA CENTRALIS

FIGURE 6. Shows the cross section of the human eye and its many parts.

EAR INJURIES

Injuries to the external ear (auricle) generally take the form of bruises, abrasions, and lacerations and are usually caused by glancing or direct blows. Injuries to the middle and inner ear are frequently caused by explosions or fractures of the base of the skull.

SYMPTOMS

Injuries of the external ear require treatment to prevent infection and to control bleeding.

Injuries caused by explosions or external pressures will exhibit severe pain, bleeding and/or a discharge of fluids, and vertigo (a dizzy feeling with a loss of balance).

EMERGENCY CARE

Lacerations and abrasions of the external ear should be treated by applying sterile pressure dressings. If the ear is severely mutilated, it will be best to apply a thick soft dressing, bandaged snugly, and transport the victim.

If the external canal leading to the inner ear is torn or otherwise injured, the area should be cautiously and lightly packed with a sterile dressing and the victim transported.

Injuries to the inner ear caused by explosions or blasts are usually extremely painful and bleed freely. No attempt should be made to clean out the ear canal or dislodge clots or pack the canal. Apply a very loose dressing to collect the flow but not to control it.

NOSE INJURIES

Injuries to the nose are generally caused by blows, kicks, falls or crushing, and can result in nosebleeds, excessive swelling, and fractures.

SYMPTOMS

Nosebleed is usually obvious and will range from moderate to severe depending upon the type and location of injury. Symptoms of fractures will include bleeding plus pain, swelling, and usually some deformity.

EMERGENCY CARE

In the care of nosebleeds that result from blows or falls, the squadman should check the escaping blood carefully to be sure that a clear fluid (cerebrospinal fluid) is not mixed with the blood. If such fluid is present, the squadman will suspect a brain injury and the victim should be placed in a prone position to permit drainage and no attempt will be made to stop the flow of blood.

Nosebleeds (epistaxis) occurring spontaneously will generally stop when a clot forms against the bleeding point. To assist the formation of a clot, the squadman can apply a steady compression of the nostrils between the thumb and forefinger for 4 or 5 minutes. Cold produces a constriction of the blood vessels in the tissues at the bleeding site, therefore, the application of a cold, wet cloth to the nose, face, neck is often very effective. The victim should be placed in a sitting position, with the head tilted slightly backwards.

For the care and treatment of nose fractures, see Page 195, Chapter XVIII.

CHEST INJURIES

Injuries of the chest may occur in many ways and combinations, and involve the chest wall, ribs, pleura (lung sac), the lungs, trachea, bronchi, esophagus, diaphragm, heart, and the major blood vessels.

Because of the involvement of the respiratory organs and breathing mechanism, many victims with chest injuries may die unless well trained personnel take quick positive action in the administration of emergency care.

Injuries to the chest may be either penetrating or non-penetrating. Open wounds are caused by a penetration of the chest wall by a knife, bullet, or other cutting object. Closed or crushing chest injuries are caused by vehicular accidents of all types, such as being thrown against the steering wheel; or having some blunt object strike the chest with force. Injuries of this type range from a bruise to a severe stove-in or flail chest, to fractures of the breast bone with contusions of the heart. Contusions of the heart may result in a very serious condition known as "cardiac tamponade," due to bleeding into the heart-sac. This prevents the heart from functioning properly and can only be treated in the hospital.

SIGNS AND SYMPTOMS

Symptoms of chest injuries will depend upon the severity of the injury. The victims will have pain due to fractured ribs; shortness of breath; and if the lung tissue itself is damaged, the victim will be coughing up blood, have oxygen hunger, and be in shock.

In injuries of the chest involving the lungs, air escapes into the lung cavity or the pleural space. The term pneumothorax describes wounds in which the vacuum which allows the lungs to expand is broken by air escaping into the cavity; the air enters either by an opening to the outside or a lung perforation. A pneumothorax of considerable size can usually be suspected by a decreased rib movement on the affected side. It may be accompanied with severe pain, difficulty in breathing and a shortness of breath. When the pneumothorax is "open" -- that is, the wound in the chest wall permits air to enter and leave the pleural space during respiration--a "sucking" sound may be heard. On the other hand, the wound may act as a one-way valve; air entering the pleural space when the victim inhales cannot escape when the victim exhales. As the air builds up in the cavity it collapses the injured lung, causes a displacement of the mediastinum to the opposite side and compresses the uninjured lung. This is called a tension pneumothorax. When this occurs breathing will be greatly impaired and the lips and fingernails may appear blue.

There is usually bleeding into the pleural cavity producing what is called a hemothorax; this may be indicated by the victim coughing up frothy blood. See Figure 7A.

Injuries causing fractures may range from one rib, to a stove-in or flail chest. Fractures of a single rib is generally indicated by sharp pain caused by breathing and resulting from grating of the bone fragments and partly from the aggravated tissue of the lung sac at the

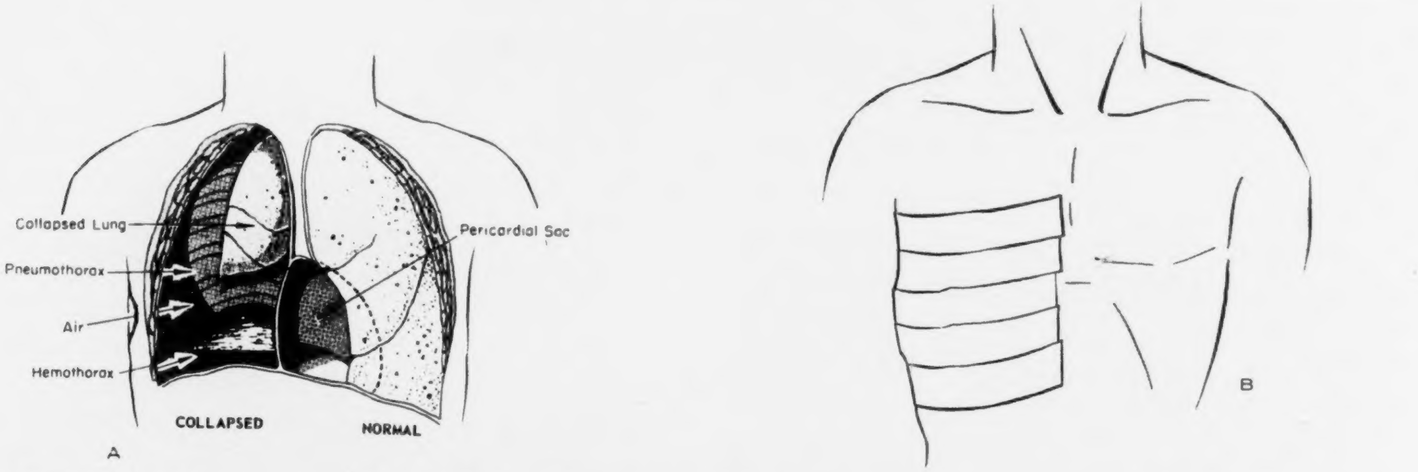


FIGURE 7. Diagrammatic sketch of penetrating chest wound. A, Shows complications; B, Application of airtight pressure bandage.

injury site. With severe multiple fractures the portion of the chest wall that is injured will not move in unison with the rest of the rib cage.

EMERGENCY CARE

A "sucking" chest wound should be suspected of all "open" chest injuries. The opening must be sealed off with some type of non-porous dressing. Aluminum foil, plastic or any similar material should be used. Make sure the opening is well sealed by overlapping 3" wide strips of tape see figure 7B. The victim should then be placed on his injured side. This will allow the uninjured lung to expand more freely and keep the victim's airway open and free of blood, vomitus and other aspirated matter. If the victim has an object protruding from his chest, he should be placed in a sitting or semi-sitting position. (Do not remove protruding objects.)

Reassure the victim, support him with oxygen, and transport to a medical facility. If during transport the victim's condition becomes worse, or "goes bad," it is usually due to air building up in the lung cavity. This is often referred to as a pressure, or tension pneumothorax, and the dressing should be removed to allow this air to escape. The dressing is then reapplied. Watch the victim continuously. It may be necessary to repeat this procedure.

To stabilize a flail or stove-in chest, the squadman may apply a firm dressing over the injured section of the chest. Sometimes the placing of a small pillow or similar object may prevent mobility. For severe cases it may be necessary to apply outward traction. This can be accomplished by taping a piece of rope, a dowel rod, or anything that can be taped to the chest and used for traction to lift this injured section of the chest. Support with oxygen, and observe the victim. If he should stop breathing, resuscitate immediately. Traction must be maintained during ventilation of this victim.

ABDOMINAL INJURIES

Abdominal injuries must be considered serious because of impending death that could result from bleeding, shock, and infection. If the major trunk arteries are involved, fatal bleeding may occur unless the victim is immediately transported to a medical facility.

The abdominal cavity is divided into four quadrants and the midline area, each containing important orgrans which may be injured. See Figure 8.

Right Upper Quadrant:

Liver, Right Kidney, Colon, Pancreas, and Gall Bladder.

Left Upper Quadrant:

Spleen, Left Kidney, Stomach, Colon, Pancreas, and Gall Bladder.

Right Lower Quadrant:

Colon, Small Intestine, Major Artery and Vein to Right Leg, Ureter.

Left Lower Quadrant:

Colon, Small Intestine, Major Artery and Vein to Left Leg, Ureter.

Midline Area:

Aorta, Pancreas, Small Intestine, Bladder, Spine.

Injuries to the solid organs such as the kidney, liver, and pancreas, produce serious internal bleeding plus inflammation due to leakage of urine, bile, and pancreatic juice; injuries of the hollow organs, such as the stomach and intestines, produce a delayed inflammation, and the acid gastric juice causes irritation and often pain.

Abdominal injuries fall into broad categories: penetrating such as caused by bullets, ice picks and knives; and non-penetrating as from collisions with objects such as furniture, blows from fists, blasts from explosives, and from crushing accidents.

SIGNS AND SYMPTOMS

The signs and symptoms of a penetrating injury are usually self evident. High velocity bullets often have a small point of entry, but the wound caused at the exit point is usually quite large due to the explosive effect inside the body. However small pieces of steel, glass, or stone may be hurled with great force as by power lawnmowers, and leave scarcely an identifiable wound of entry. Also the object may enter the body outside of the abdominal area, but lodge inside the abdomen. Pain is usually severe and may be accompanied by nausea and vomiting.

In non-penetrating wounds, an injury to the internal organs may not be suspected because of other symptoms produced by additional injuries, such as severe pain caused by fractures of the ribs may mask symptoms indicating an injury to the liver or spleen. Nausea and vomiting should alert the squadman to the possibility of abdominal injuries especially if the vomited matter contains blood. Pain and abdominal tenderness to hand pressure and a rigidity of overlying muscles is an indication of the location of the organs involved.

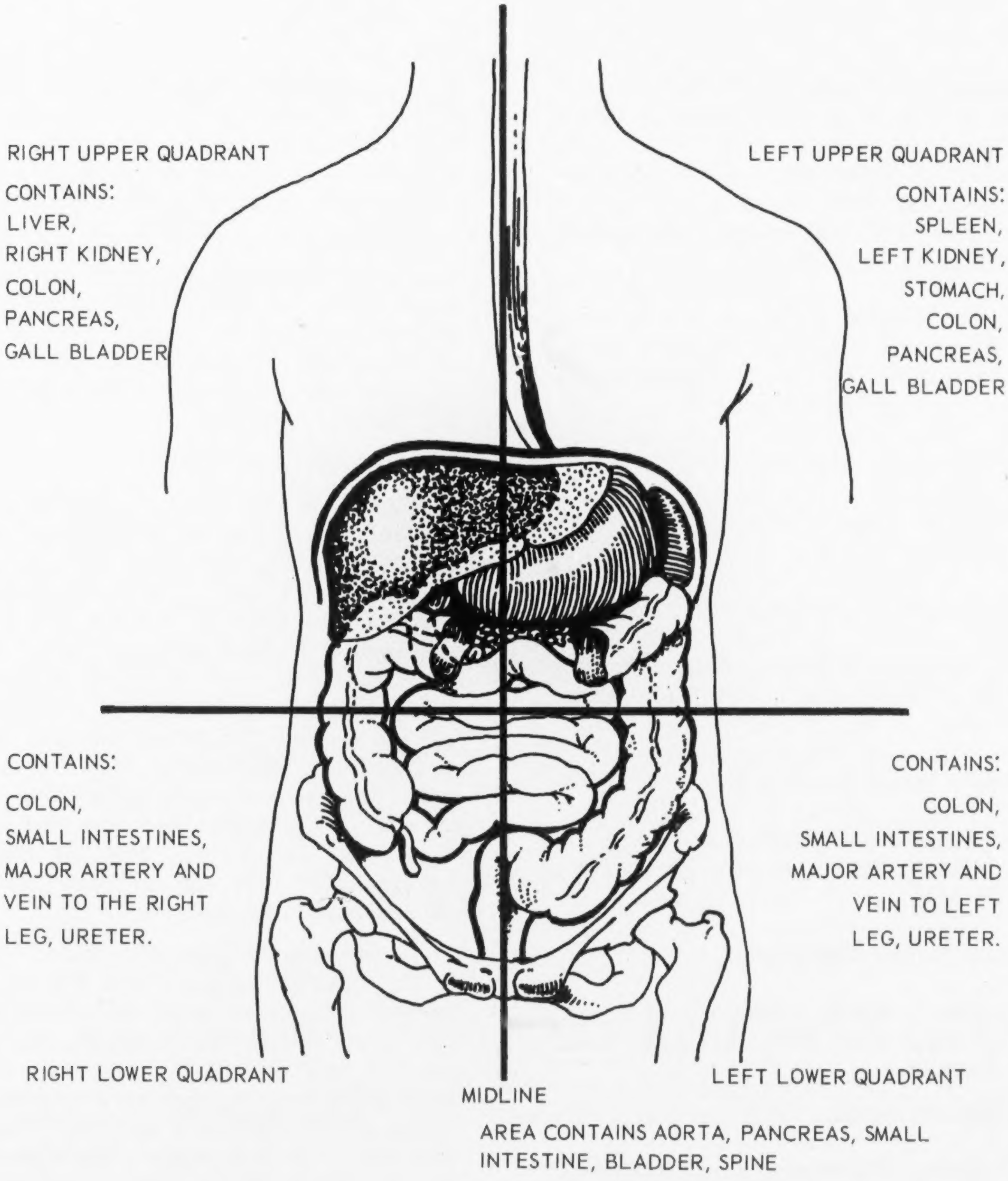

RIGHT UPPER QUADRANT
CONTAINS:
LIVER,
RIGHT KIDNEY,
COLON,
PANCREAS,
GALL BLADDER
LEFT UPPER QUADRANT
CONTAINS:
SPLEEN,
LEFT KIDNEY,
STOMACH,
COLON,
PANCREAS,
GALL BLADDER
CONTAINS:
COLON,
SMALL INTESTINES,
MAJOR ARTERY AND
VEIN TO THE RIGHT
LEG, URETER.
CONTAINS:
COLON,
SMALL INTESTINES,
MAJOR ARTERY AND
VEIN TO LEFT
LEG, URETER.
RIGHT LOWER QUADRANT
LEFT LOWER QUADRANT
MIDLINE
AREA CONTAINS AORTA, PANCREAS, SMALL
INTESTINE, BLADDER, SPINE

FIGURE 8. **The abdominal cavity showing the contents of each quadrant**

Shock (pallor; cold clammy skin; rapid, thready pulse; low blood pressure) generally accompanies abdominal injuries.

EMERGENCY CARE

In the treatment of abdominal injuries the squadman will cover all open wounds with a sterile dressing over which is placed a compression binder. This binder should be a scultetus or many-tailed binder. See Figure 9. The scultetus binder consists of a square of heavy muslin or flannel material about twelve inches square, to which a series of straps, of the same material, two inches wide and eighteen inches long have been sewn on two opposite ends. The square is placed on the victim's back and the straps are then alternately brought around the victim's abdomen. The straps are pulled snug, each strap overlapping the previous one to hold it and the dressing in place. See Figure 10.

If organs or bowels protrude, make no attempt to replace them. Cover them with large sterile dressing moistened with sterile water. After covering, apply the scultetus binder, but not so tightly as to interfere with circulation. Give nothing by mouth -- no food or fluids. The victim will be most comfortable with his knees flexed, and in a semi-sitting position. If the victim vomits, make every effort to prevent aspiration of the vomitus.

In summary, the care of abdominal injuries consists of:

1. Suspecting that an abdominal injury exists.

2. Maintain an open airway and support with oxygen.

3. Caring for any protruding organs.

4. Apply a moist dressing and a scultetus binder.

5. Transport to a medical facility with a high degree of priority.

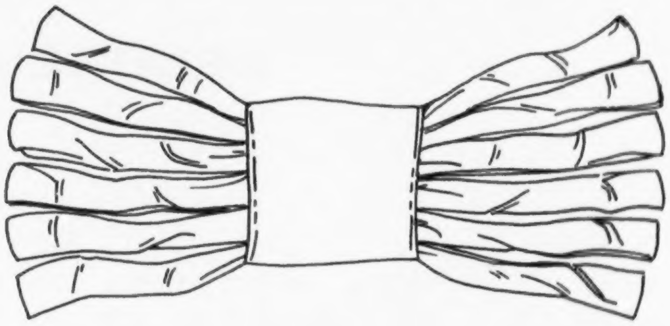


FIGURE 9. The scultetus binder or many-tailed binder can be used for several kinds of emergencies.

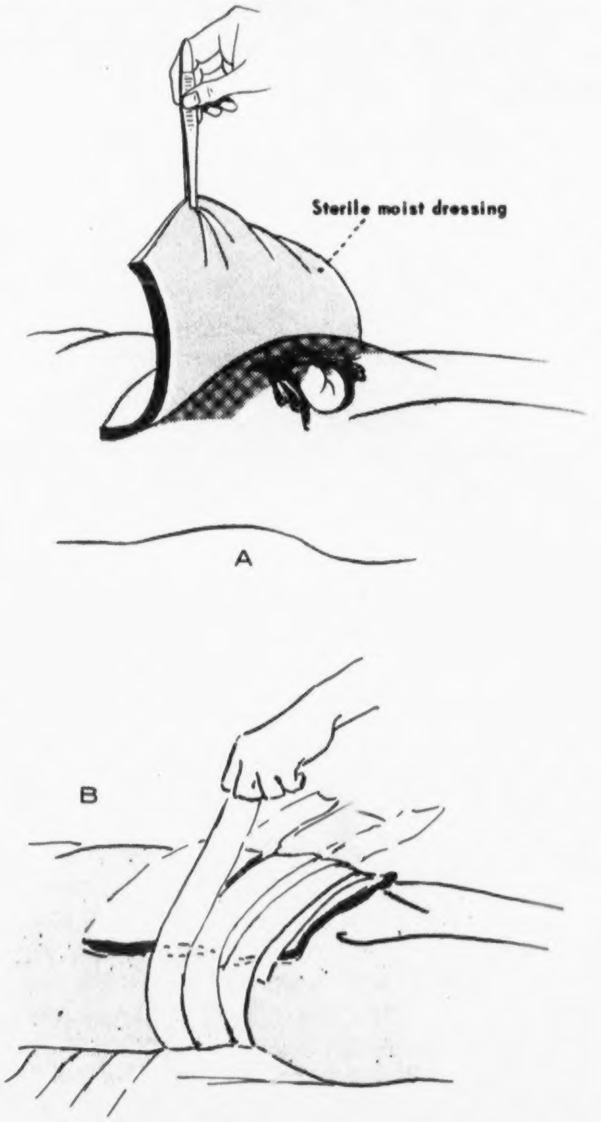


FIGURE 10. Abdominal wound with protrusion of intestine. A, Shows application of sterile, moist dressing; B, Application of scultetus (many-tailed) binder.

GENITALIA INJURIES

Direct injury to the gentalia may result from falls, direct blows, and explosions. Inserted objects and zippers are common causes of genitalia injuries of children.

SYMPTOMS

Depending on the severity of the injury, symptoms may be shock, intense pain (the victim may be in agony) and bleeding.

EMERGENCY CARE

The care of genital injuries is the same as that of other soft tissue damage. Do not remove pentrating or inserted objects, control bleeding with a sterile pressure dressing, treat for shock, and transport lying down. Caution should be used for zipper injuries; it may be best to make no attempt to open the zipper.

CHAPTER XXII

BURNS AND ENVIRONMENTAL INJURIES

BURNS

Burns are injuries to the skin and/or underlying tissues resulting from contact with heat, chemicals, electricity, or radiation.

CLASSIFICATION OF BURNS

Burns are classified as to the cause of the burn, the extent of the burned surface, the depth of the burn, the location of the burn, and the age of the victim.

CAUSE OF BURNS

Burns are generally caused by heat, chemicals, electricity, and radiation.

Heat may be moist such as from steam or boiling water, or dry such as fire, hot metal, or other hot objects.

Chemicals such as acids and alkalies can cause serious burns.

Electricity causes burns not only at the point of contact or entry to the body, but also at the point of exit. In addition to the burn injury, serious conditions may result from paralysis of the breathing control center or a convulsive action of the heart referred to as ventricular fibrillation.

Radiation burns include ultraviolet rays, x-rays and radium. Sunburn and burns from ultraviolet lamps usually are superficial and produce short-lived effects.

Regardless of the cause, if burns are extensive, shock will be present.

EXTENT OF BURNS

To determine the extent of burned surface, the "Rule of Nines" is used. See Figure 1. All emergency medical personnel should memorize the indicated percentages. They can then estimate the extent of the burn and transmit this information to the hospital, for this figure will aid in determining the correct treatment for the burned victim.

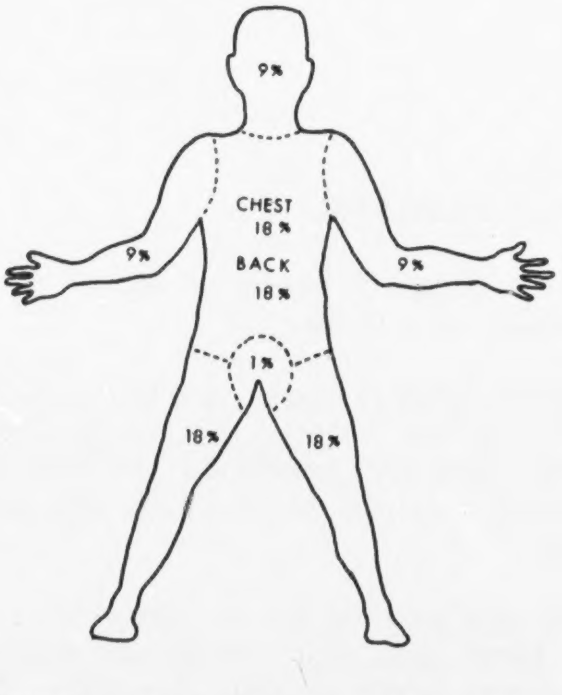


FIGURE 1. Body burns expressed in percentage of total skin surface.

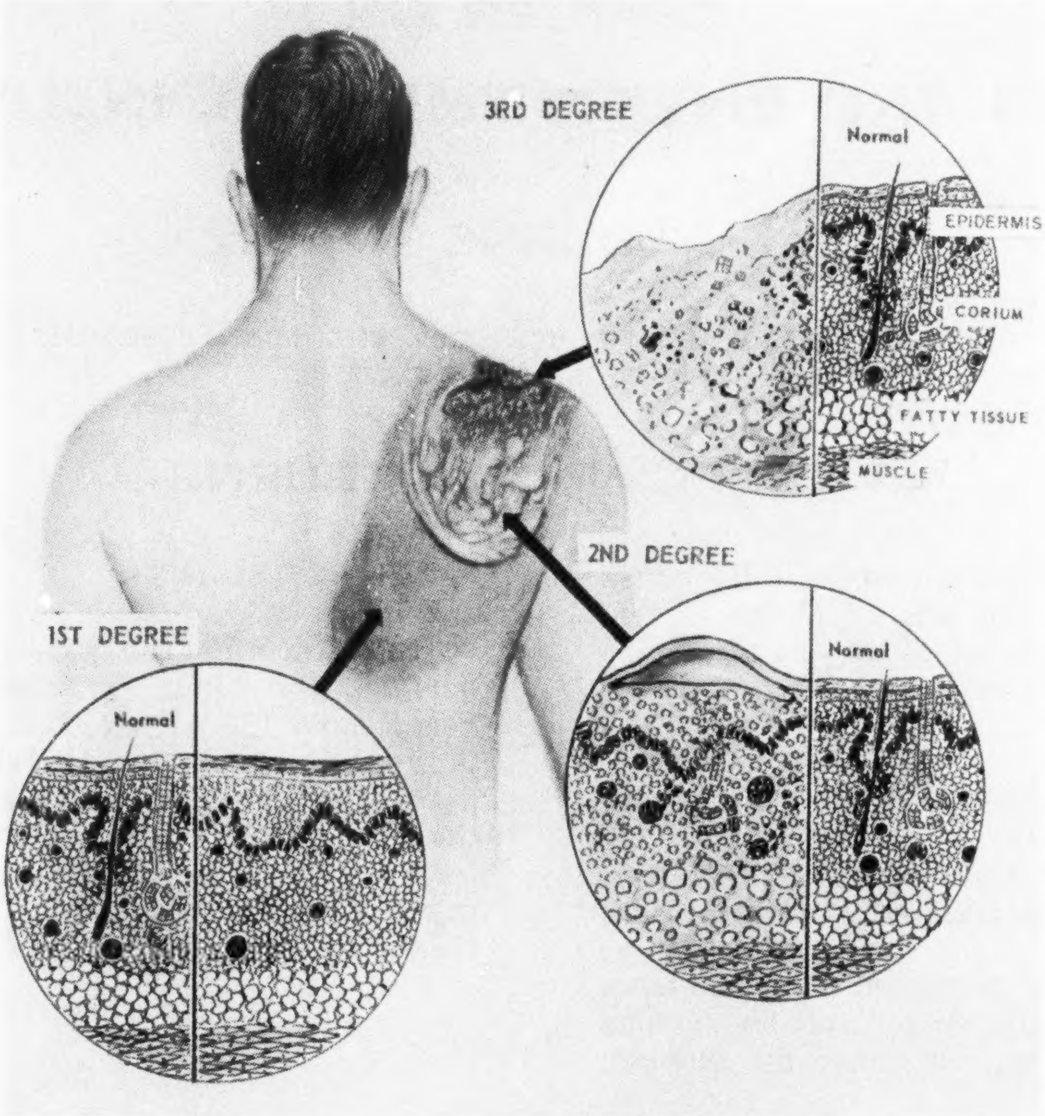


FIGURE 2. Degrees and types of burns

DEPTH OF BURNS

The depth of burns is spoken of in degrees. See Figure 2.

First Degree burns are the mildest, involving the outer layer of the skin (epidermis) and producing redness, increased warmth, tenderness, and mild pain.

Second Degree burns extend through the outer skin (epidermis) and involve the under layer of skin (dermis). Second degree burns produce blisters and are characterized by severe pain.

Third Degree burns are full thickness, destroying both the epidermis and dermis. Pain is usually absent because nerve endings have been destroyed. Color may range from white and lifeless as from scalds and steam, to black and charred as from oil or gasoline fires.

LOCATION OF BURNS

Burns of the respiratory tract are very serious and may be suspected from burns about the mouth, by coughing, spitting up of blood and carbon particles and difficult breathing due to the swelling of the larynx. The swelling of the larynx is a serious condition that requires immediate removal to an adequate medical facility, for an emergency tracheostomy must be performed in many cases.

Burns complicated by fractures or soft tissue damage must be considered critical.

AGE OF VICTIM

The age and health of a burned victim play an important part toward ultimate recovery. The very young and the very old may suffer burns of the same degree and extent as a person in his mid-twenties and not survive, whereas the victim in his mid-twenties will show a remarkable recovery.

EVALUATION OF BURNS

MINOR BURNS

Second degree burns of less than 15% *or third degree burns of less than 2%* are classified as minor burns.

MODERATE BURNS

Second degree burns of 10% to 30%, and third degree burns of less than 10% are considered moderate if the hands, face, and feet are not involved.

CRITICAL BURNS

Second degree burns of 30% or more, third degree burns of 10% or more, burns that have involved the respiratory tract, and those burns that have been complicated by fractures and other soft tissue damage must be considered as being critical. Third degree burns involving the face, hands, and feet are always critical.

EMERGENCY CARE OF BURNS

The existing controversy as to the use of wet dressings or dry dressings is only shadowed by the many existing burn treatments in use in hospitals and clinics throughout the country. Due to this lack of uniformity, this writer, upon advisement of his medical advisor, suggests the following procedure:

Emergency care of burns must be in accord with the local medical and hospital procedure.

If in doubt or lacking medical direction, apply only dry sterile dressings and burn sheets. Upon arrival at the hospital, the physician can then institute his treatment of choice.

The immediate care for burns must involve the following items:

1. Relieve pain.

2. Prevent or treat shock.

3. Prevent infection and further contamination.

The application of thick dressings will exclude the air and this will ease the pain. Dressings should be applied snugly but not so tight as to interfere with circulation.

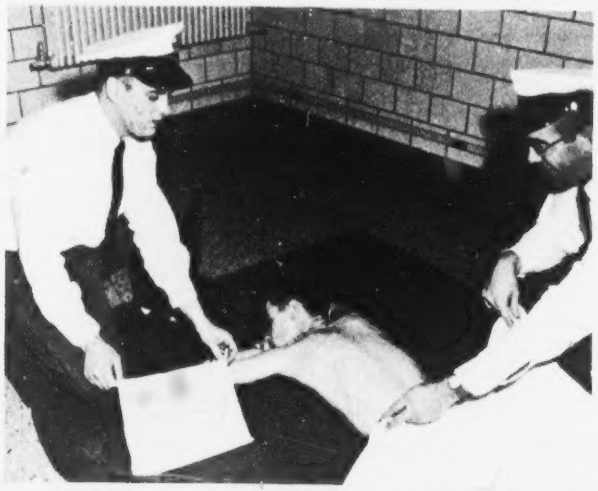
Shock will be present in one degree or another and must be treated as outlined in Chapter XIV.

To prevent infection and further contamination of the burned surface, use only sterile dressings and burn sheets. See Figures 3, 4, 5.

COLD WATER TREATMENT

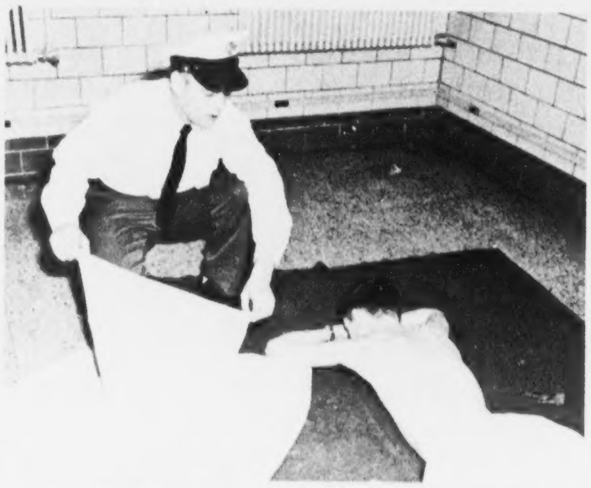
For burns involving the extremities, immersion in cold water or the use of cold moist towels has proved to be a most effective method of immediate care. This treatment, to be effective, must be continued until no pain is felt when the burned area is removed from the water. The time involved ranges from 25 minutes up to several hours. When the limb is finally removed from the water, it must be dressed with sterile material.

It is realized that clean water and ice are not always available, but when practical this method provides relief of pain and a decrease in the amount of tissue damage.



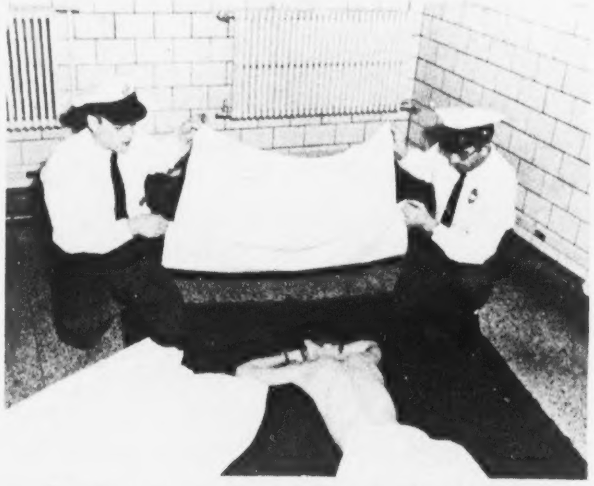
Courtesy St. Anthony Hosp. & Pleasantville F.D.

FIGURE 3. The squadmen on this call are confronted with a burn of all three degrees which involves the entire left side of the back. The victim is being treated for shock by one squadman as the other man readies the burn sheet.



Courtesy St. Anthony Hosp. & Pleasantville F.D.

FIGURE 4. The outside wrapper having been opened, the burn sheet is very carefully unfolded. Notice that the squadman is touching only the very corners of the sheet. This will make for a sterile area covering the burns. The sheet is handled in the same manner as when removing a sterile compress from its wrapper.



Courtesy St. Anthony Hosp. & Pleasantville F.D.

FIGURE 5. With the utmost care, cover the burn area and wrap the rest of the sheet around the victim. Do not use ointments or sprays of any kind on second-degree or third-degree burns.

CHILL FACTOR

Wind in m.p.h.				Local Temperature in Degrees Fahrenheit							
	32	23	14	5	-4	-13	-22	-31	-40	-49	-58
			Equivalent Temperature (Wind Plus Local Temperature)								
Calm	32	23	14	5	-4	-13	-22	-31	-40	-49	-58
5	29	20	10	1	-9	-18	-28	-37	-47	-56	-65
10	18	7	-4	-15	-26	-37	-48	-59	-70	-81	-92
15	13	-1	-13	-25	-37	-49	-61	-73	-88	-97	-109
20	7	-6	-19	-32	-44	-57	-70	-83	-98	-109	-121
25	3	-10	-24	-37	-50	-64	-77	-90	-104	-117	-130
30	1	-13	-27	-41	-54	-68	-82	-97	-109	-123	-137
35	-1	-15	-29	-43	-57	-71	-85	-99	-113	-127	-142
40	-3	-17	-31	-45	-59	-74	-87	-102	-116	-131	-145
45	-3	-18	-32	-46	-61	-75	-89	-104	-118	-132	-147
50	-4	-18	-33	-47	-62	-76	-91	-105	-120	-134	-148
	little danger for those properly clothed →		considerable danger →			extreme danger →					

FIGURE 6. The chill factor - temperature plus wind

COLD INJURIES

Although there are many ways in which cold injures, most of the tissue damage results from circulation impairment brought about by exposure to severe cold or prolonged cold. The extent of tissue and circulatory damage is directly related to intensity of cold, duration of exposure and such other factors as wind, see Figure 6, wetness, clothing, and other existing injuries.

Cold injuries can be classified as chailblains, immersion foot, trench foot, frostbite, and freezing. See Figure 7. However, these classifications only describe the mode of injury. Basically, there are two types of cold injuries: freezing and non-freezing.

SIGNS AND SYMPTOMS

The involved area may present several degrees of injury without regard to a regular pattern of progression. Figure 7 shows the times and temperatures involved in producing cold injuries and the symptoms which each level or type of injury can be expected to present.

EMERGENCY CARE

Cold injuries should never be treated lightly because of the tissue loss and nerve damage which are frequently associated. If frostbite or freezing has occurred, the extremity should be soaked in a water bath of 104° to 108° Fahrenheit. The affected parts must not be rubbed or massaged as this damages and destroys the tissue.

As thawing occurs, the victim may experience intense pain. Treat for shock and transport to a medical facility.

Classification of injury	Time and temperature factors*	Symptoms
1st degree: Chilblains Pernio	Repeated exposure, several hours at a time, to temperatures between 32°** to 60°; generally associated with high humidity.	Redness and swelling; itching, burning dermatitis; tingling, and later deep-seated ache.
2d degree: Immersion foot	Exposure to cold water (50° and below) 12 hours or more; or, to water of approximately 70° for several days. Immobilization, dependency.	Swelling legs and feet, cyanosis, numbness, tingling, itching, blisters, pain, neuromuscular changes.
Trenchfoot	Exposure to cold (32° to 50°), damp weather several hours to 14 days (average 3 days). Dependency, immobilization, constrictive clothing.	Part blanches, tingles, then becomes numb. Swelling legs and feet; cyanosis; blisters; intense burning pain; neuromuscular changes.
3d degree: Frostbite	Generally, brief exposure to extreme cold (−20° and below), or exposure to approximately zero weather for several hours.	First burning, stinging, then numbness. Ice crystals in skin cause gray or white waxy color. Skin will move over bony prominences. Edema; blebs; aching pain requiring medication; limitation of motion. Later gangrene, loss of tissue.
4th degree: Freezing	Exposure to −20° to −60° and below. May happen rapidly to exposed fingers and toes with extension as exposure is prolonged.	Ice crystals in entire thickness of part including bone, indicated by pallid, yellow, waxy color. Skin will not move over bony prominences. Edema; large blebs; intense pain; loss of motion. Later gangrene, loss of part.

FIGURE 7. Classifications and symptoms of cold injuries

ABNORMAL LOWERING OF BODY TEMPERATURE

Occasionally a victim of abnormal lowering of general body temperature (hypothermia) may be encountered. Such a condition is generally brought about by total immersion in cold water, and loss of consciousness (perhaps through injury or intoxication) in winter weather with prolonged exposure in inadequate clothing.

SIGNS AND SYMPTOMS

The victim will appear pale and if unconscious may be taken for dead. Respirations are slow and shallow, and the pulse is weak. The pupils do not react to light but are not dilated, skin tissue will feel semirigid.

EMERGENCY CARE

Bring the body temperature up to normal by wrapping the victim in a blanket and placing him in a warm room. Administer oxygen and maintain an open air passage. As the victim's temperature rises, he will gradually become responsive. It is advised at this time to encourage deep breathing.

If the victim should stop breathing, begin resuscitation and transport.

EMERGENCIES DUE TO HEAT

When an individual exerts himself in a hot environment, a considerable portion of his circulating blood must be directed to the vessels of the skin in order to radiate heat from the skin surface and to support the action of the sweat glands.

When the nerves which control the expansion and contraction of the blood vessels (vasomotor control) and the heart are unable to meet the needs of increased circulation to the skin, muscles, and brain, the individual will collapse. The usual heat emergencies are heat exhaustion, heat cramps, and the most serious, heat stroke.

HEAT EXHAUSTION

CAUSE

Heat exhaustion is caused by exposure to heat. It may occur outdoors in a hot, humid atmosphere, but most often it occurs in such places as laundries, bakeries, and foundries. It usually follows overeating plus overdrinking of iced liquids. Heat exhaustion must not be mistaken for heat stroke.

SIGNS AND SYMPTOMS

Heat exhaustion usually begins with dizziness, weakness, nausea, and vomiting. The victim will have a feeling of exhaustion, and have difficulty in walking. The pupils will be dilated, the pulse will be fast and weak, breathing will be rapid but shallow, and the skin will be pale, cool, moist, and clammy. Sweating will be excessive over the entire body, and the victim may lapse into unconsciousness.

EMERGENCY CARE

Place the victim in a reclining position in a cool environment. The victim who has fainted will usually gain consciousness in a short time. He must be kept at rest and given a salt-water solution to drink. A 1/4 teaspoon of table salt to a pint of water is an adequate solution.

HEAT CRAMPS

CAUSE

Heat cramps is a condition affecting certain individuals who do heavy work in hot places or during extreme summer heat. Heat cramps occur as a result of an individual drinking large quantities of water followed by profused sweating and the loss of salts.

SIGNS AND SYMPTOMS

With profused sweating, salts are lost from the body causing initially slight muscle twitching in the abdomen and extremities. This progresses to violent, painful muscle cramps. The victim does not usually lose consciousness but will complain of severe pain. Some symptoms of heat exhaustion may accompany the cramps, and breathing may be somewhat impaired if the respiratory muscles are involved. This condition, being very painful, is seldom considered dangerous.

EMERGENCY CARE

The treatment of heat cramps is salt--either in tablet form or as salted drinking water. Manual pressure and massage may give some relief to the cramped muscles. As is often the case, the best treatment is prevention and individuals should be persuaded to take salt tablets when working in hot environments.

HEAT STROKE (SUN STROKE)

CAUSE

Heat stroke can be recognized by the extreme elevation of body temperature due to the failure of the body sweating mechanism, or the overall body temperature regulating mechanism. This is a most complex system that regulates the body's temperature whether an individual lives in the North Pole or the Equator. It can be caused by prolonged exposure to the direct rays of the sun, exposure to excessive indoor heat, too much clothing in a hot environment, or possibly alcoholism.

SIGNS AND SYMPTOMS

The victim may occasionally be aware of the absence of sweating, but often his first indication is a sensation of extreme heat. Weakness, headache, dizziness, mental confusion, delirium, and unconsciousness are progressive symptoms. The victim's skin will appear flushed, hot and dry. Early, his pupils are constricted, and later, as the condition progresses, they will dilate. His pulse rate may be 160 or more. Breathing will be rapid and usually of the snoring type. Temperature may rise rapidly to 105° or higher, convulsions, vomiting, shock, and circulatory failure occur leading to death.

EMERGENCY CARE

The care of the heat stroke victim calls for immediate action to quickly reduce the body temperature to prevent brain damage and death.

Remove the victim to a cool environment if possible. Immediately apply measures to reduce the body temperature for brain damage is the product of time as well as temperature.

Total immersion in an ice water bath is probably the most efficient method, but it is certainly not the most practical.

Apply cold cloths or an ice pack to the head, the body must be wrapped in coldwater soaked cloths. Continue to pour cold water on the cloths during transport and gently massage the victim to assist the circulation of the cooled blood to the brain. If the victim is unconscious, maintain an open air passage. Transport to a medical facility as soon as possible.

CHAPTER XXIII

CHILDBIRTH

INTRODUCTION

A growing problem confronting the emergency medical service is emergency childbirth. The squadmen often have to decide whether to transport the expectant mother to where medical help is available, or whether to keep the mother in her home and attend the birth of the child. Because squadmen must solve this problem, it is of the utmost importance that all squadmen have some fundamental knowledge about the conditions surrounding childbirth.

NORMAL DELIVERIES

A woman in labor and/or a new-born child can certainly present many difficult situations. Unless the squadmen have proper knowledge and training in this particular area of emergency care, great harm may be done to the mother and/or the child.

Although it is not the intention of this book to perfect the squadmen in the art and science of obstetrics, there is a real need to give such personnel a working knowledge of what to expect. Because lives may be in the balance, the squadmen must decide quickly either to transport or not to transport a mother to a hospital. The decision should depend upon certain evidence which the squadman has to evaluate at once.

The expectant mother is to be transported only before the evidence of crowning is apparent. If crowning is apparent, childbirth will follow soon after. In such a case, the mother should not be moved at all, unless the squadmen are otherwise directed by a physician.

The squadmen must have some concept of what takes place before, during, and after labor to be able to best care for the mother and child. However, this material will deal mainly with the period during labor since this is usually the period in which victim care arises. Therefore, the squadmen should have some knowledge of what is normal and abnormal in childbirth.

DEFINITIONS

Obstetrics: The care of the childbearing woman and her new-born baby. Obstetrics deals basically with three distinct periods:

1. Pregnancy: The period from conception throught the period of labor to birth of the child.

2. Labor: The period during which the baby and the placenta are expelled from the mother's body into the outside world.

3. The Puerperium (Post Delivery): The period during which the organs of reproduction are restored to approximately their former size and condition. This usually takes about six weeks.

Internal Organs: The internal organs of reproduction are (a) the ovaries, (b) the fallopian tubes, (c) the uterus, and (d) the vagina.

Ovaries: The ovaries are the glands in the female producing the reproduction cell known as the ovum.

Fallopian Tubes: The fallopian tubes are two thin, trumpet-shaped, flexible muscular tubes, about four and one half inches long and somewhat thinner than a lead pencil. They have two openings, one into the uterine cavity and the other into the abdominal cavity. The abdominal opening is somewhat larger and is surrounded by a large number of fringes; hence the term "fimbriated end". The fallopian tubes act as a passage from the ovaries to the uterus.

Uterus: The uterus, or womb, is a thickwalled, muscular, hollow, pear-shaped organ. Fully developed, in non-pregnant state, it is approximately three inches long, two inches wide, one inch in thickness, and weighs from one to two ounces. It is composed of in-involuntary muscle fibers, running in different directions, making its expansion possible up to the size of a pumpkin. At termination of pregnancy it weighs about two pounds. The muscles of this organ are arranged so as to make it able to expel its fetus (infant) by contraction at the termination of normal labor. (See Figure 1.)

Amnion (Bag of Waters): The thin transparent sac which holds the fetus suspended in the fluid called amniotic fluid. This sac is lined with a smooth, slippery, glistening membrane. The space, or the amniotic cavity filled with fluid, is often called "the bag of waters." Here is where the child floats and moves. At full-term pregnancy this cavity normally contains from one half to one quart of water. The important functions of this fluid are:

1. To protect the fetus from blows

2. To allow the fetus freedom of motion

3. To keep the child at an even temperature

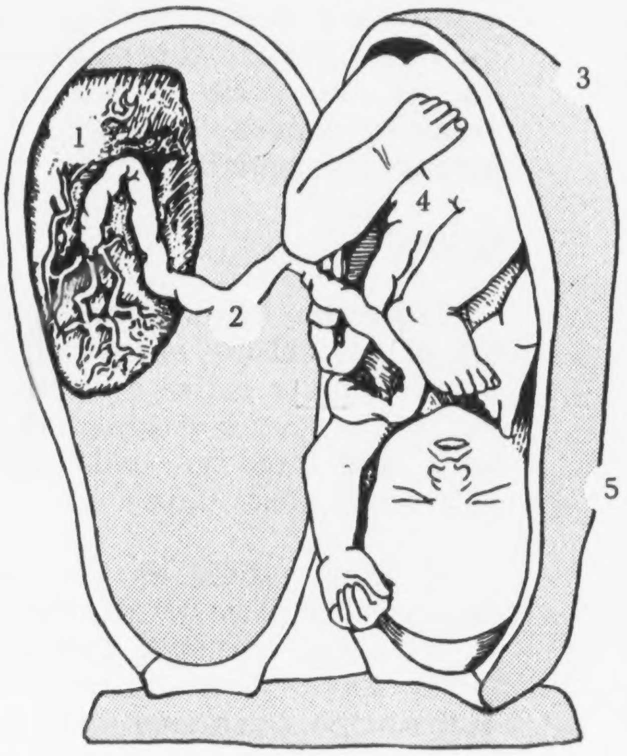
4. To help to enlarge the vaginal canal during labor so the child may be born more easily.

5. When membranes rupture, to flush the birth canal, thereby cleansing, lubricating, and disinfecting it.

Placenta (Afterbirth): By the third month another important structure, the placenta, has formed. The placenta is a fleshy, dishlike organ. Late in pregnancy it measures about eight inches in diameter and one inch in thickness. It receives its name from a Latin word meaning cake, which this structure resembles somewhat in shape.

A tree or a plant sends its roots into a bed of earth for nourishment, and when the plant is removed a certain amount of the earthy bed clings to the interlocking roots. Similarly, a thin layer of the uterine bed clings to the branching projections and together they make up this organ, which supplies food to the fetus as the roots and the earth provide nourishment for a plant. At term a placenta weighs about one pound. Its surface is smooth and glistening, and beneath this membrane may be seen a number of large blood vessels.

The placenta and the child are connected by means of the umbilical cord. This cord is fastened to the center of



1. Placenta: usually attached on rear wall
2. Umbilical cord: it is about 20 inches long
3. Fundus of uterus
4. Infant's navel
5. Front wall of uterus

FIGURE 1. Unborn child

the placenta and from there enters the abdominal wall of the child. It is usually about twenty inches in length and three quarters of an inch in diameter. It contains two arteries and one large vein, which are twisted upon each other and are protected from pressure by a transparent, bluish-white, gelatinous substance called jelly.

LABOR

Labor is the process by which the child is expelled from the uterus. It is divided into three stages: dilation, expulsion, and placental.

FIRST-STAGE "DILATION"

The first stage of labor begins with the first symptoms of true labor and ends with the complete dilation of the vaginal canal.

EMERGENCY CARE

1. Reassure the victim. The squadman should display an attitude of cheerfulness, sympathy, and encouragement toward the expectant mother.

2. Observe the character of the pains. The frequency, the duration, and the intensity of the pains should be watched closely and recorded. The presence of "show" in substantial amounts (blood-stained mucus, not actual bleeding) suggests that rather rapid progress may be taking place and should be reported, particularly if associated with frequent severe pains.

3. Urge the victim not to bear down. During the first stage of labor, uterine contractions are involuntary and uncontrolled by the victim. Not only is it futile for her to bear down, this leads to exhaustion and may tear parts of the birth canal.

If the squadman determines that the mother is in the first stage of labor, preparations should be made to transport her to the hospital.

SECOND STAGE – EXPULSION.

Watch for signs of the second stage. These signs are as follows:

1. The victim begins to bear down on her own accord.

2. There is a sudden increase in vaginal discharges; sometimes there may be slight actual bleeding. This indicates that the child's head is passing through the completely dilated birth canal.

3. The victim thinks that she needs to evacuate; this symptom is due to pressure of the head on the perineal floor and consequently against the rectum.

4. The membrane ruptures with discharge of fluid. This, of course, may take place at any time but occurs most frequently at the beginning of the second stage.

5. The vaginal opening begins to bulge and the anal orifice to dilate. This is a late sign, but if 1, 2, 3, and 4 occur, the appearance of the infant should be watched for, with every pain. Only the appearance of the head (crowning) can definitely confirm this suspicion. Vomiting at this time is not unusual. If vomiting occurs, take precautions against strangulation.

Crowning

The vaginal opening will bulge and the top of the child's head will actually be seen. This is called crowning. Crowning is the very last symptom before the head and then the child are actually delivered. (See Figure 2.)

If examination of the birth canal during labor pain reveals that the mother is crowning, this will indicate that the infant may be born almost immediately. In this case, squadmen should not attempt to transport the mother to a hospital, but should be prepared to deliver the baby in the next few minutes. If she is not crowning during a labor pain, squadmen will probably have time to reach a hospital. In such case, the mother should be transported.

If it is established that the squad must help in the delivery, one squadman should obtain the following equipment from the squad vehicle: (a) O.B. kit, (b) bag-mask, (c) oxygen inhalator. This equipment should be brought to the delivery area and made ready. (See Chapter II - page 22, Figure 17 for the contents of the emergency O.B. kit.

Figures 3 through 10 show stages of a normal delivery. The head usually is delivered with the face down and rotates toward one of the mother's legs. It should be supported by the rubber-gloved hand of a squadman. Gloves should be sterile.

While supporting the head, check to find out if the cord is wrapped around the neck. If it is, run your finger between the cord and the child's neck to loosen the cord. If the cord is too tight, clamp it twice and cut between clamps.

After the head is delivered, contraction of the uterus will continue until the shoulders are delivered. Do not pull. The mother sometimes has difficulty delivering the shoulders because of their width. The top shoulder is usually the first one to present itself. Slight traction of the head toward the floor will help deliver the upper shoulder (see Figure 7). Slight traction on the head toward the ceiling will help deliver the bottom shoulder. Continue to support the child and be ready for sudden expulsion. After both shoulders are delivered, the baby may follow very quickly. Guard the cord so as not to tear it.

Figures 2 thru 15 Courtesy, Dept. of Obstetrics, Euclid General Hospital
By Robert C. Waltz, M.D.

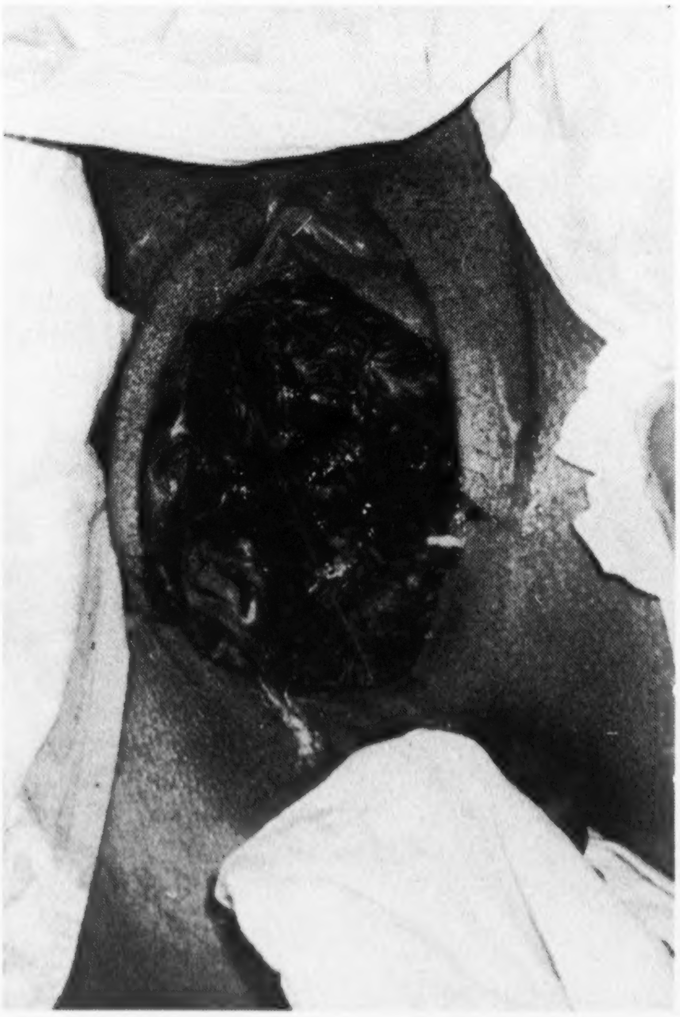


FIGURE 2. "CROWNING" The appearance of the baby's head at the height of a labor pain.

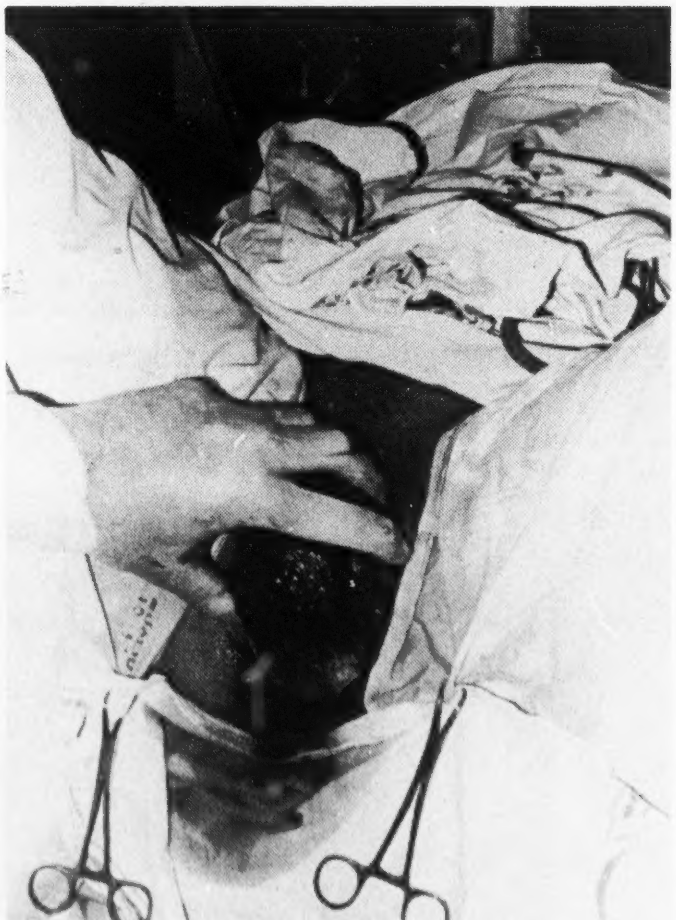


FIGURE 3. Support the baby's head as it continues through the birth canal.

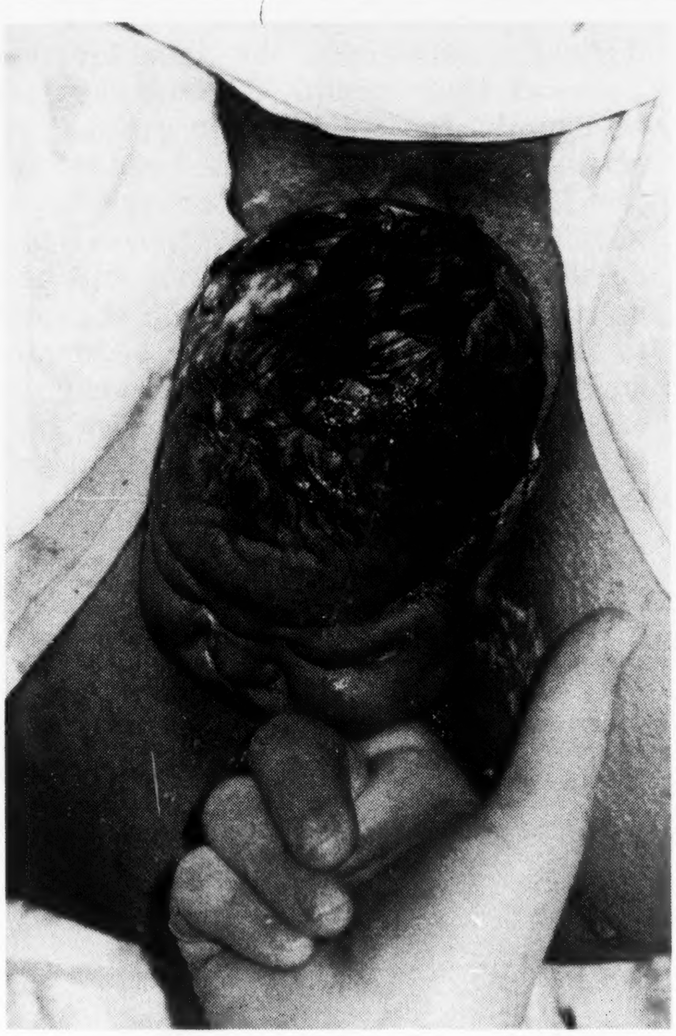


FIGURE 4. Delivery of the baby's head.

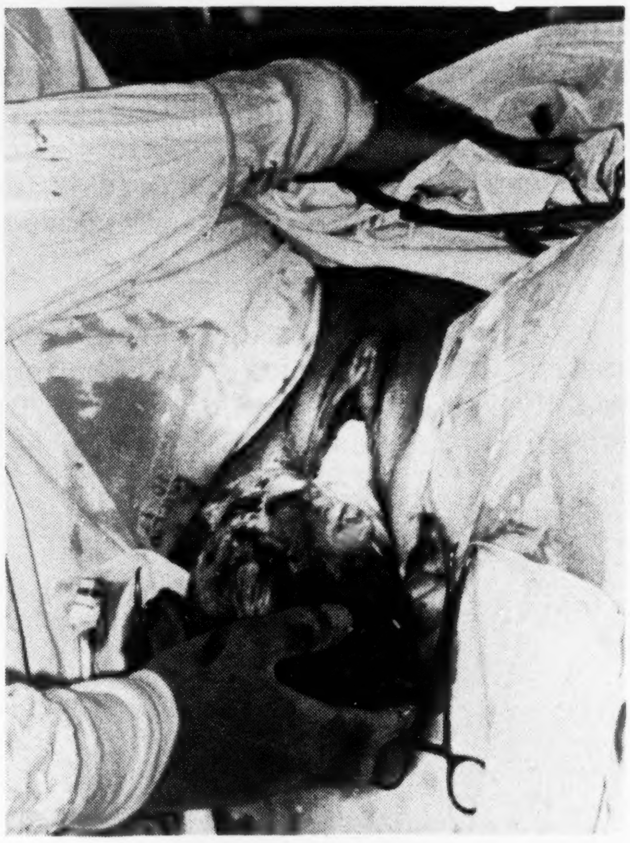


FIGURE 5. Head and neck completely delivered. If the cord is wrapped around the neck, attempt to loosen it with your finger. If the cord is tight, clamp it twice and cut between the clamps

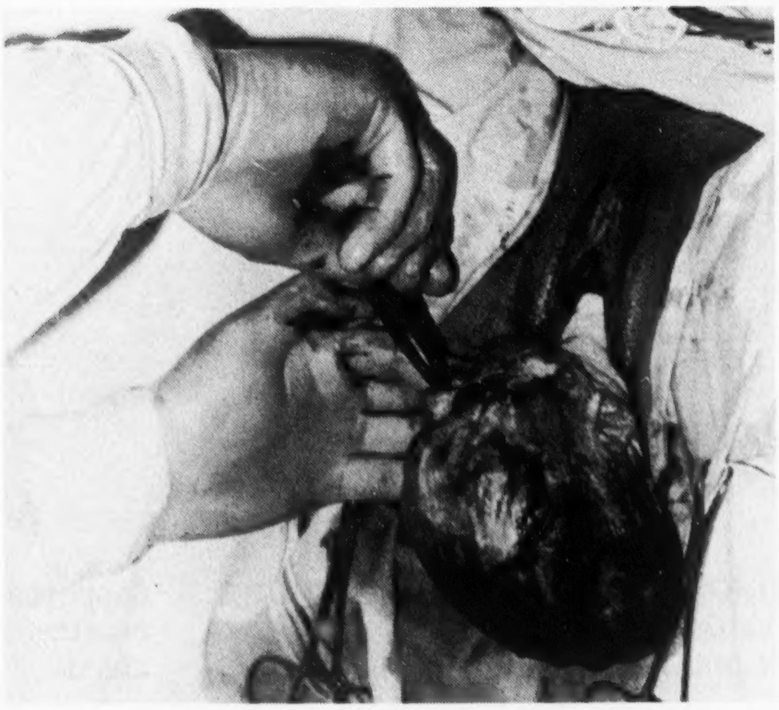


FIGURE 6. Aspirate the baby's mouth and nose.

FIGURE 7. Delivery of the shoulders, if necessary, can be accomplished with slight traction on the head; down, to assist delivery of the top shoulder, and up, to assist delivery of the bottom shoulder. DO NOT PULL.

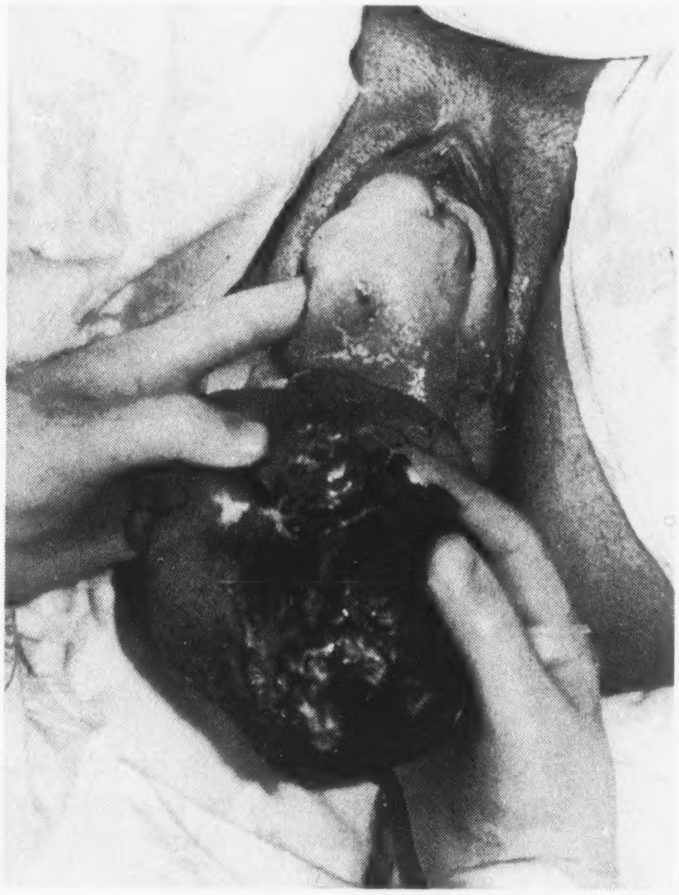
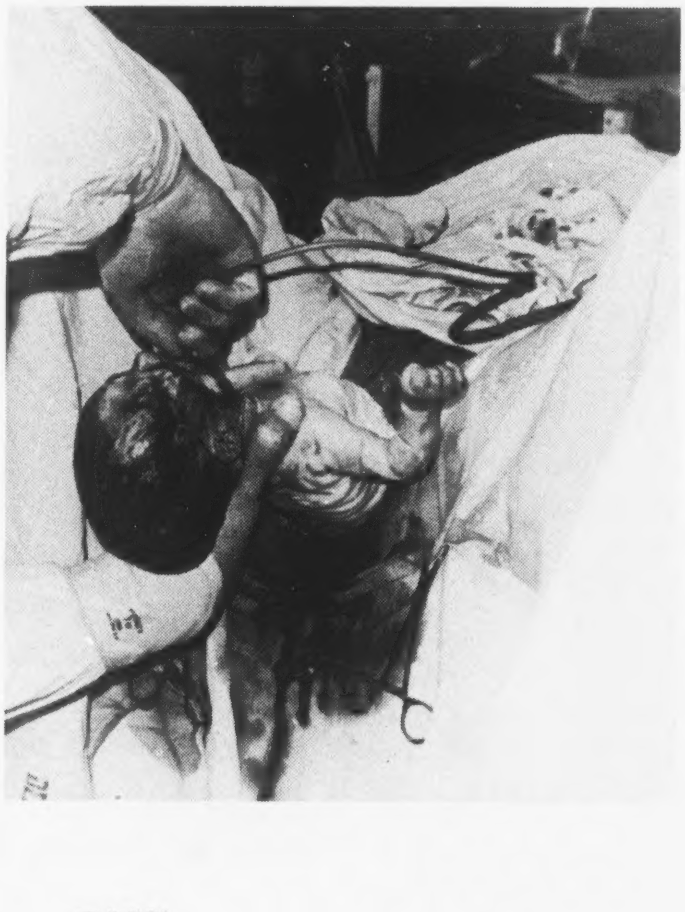


FIGURE 8. Continue to support the baby, expulsion may be very rapid. (The pictured birth has not been rapid and aspiration is continued with a suction catheter.)



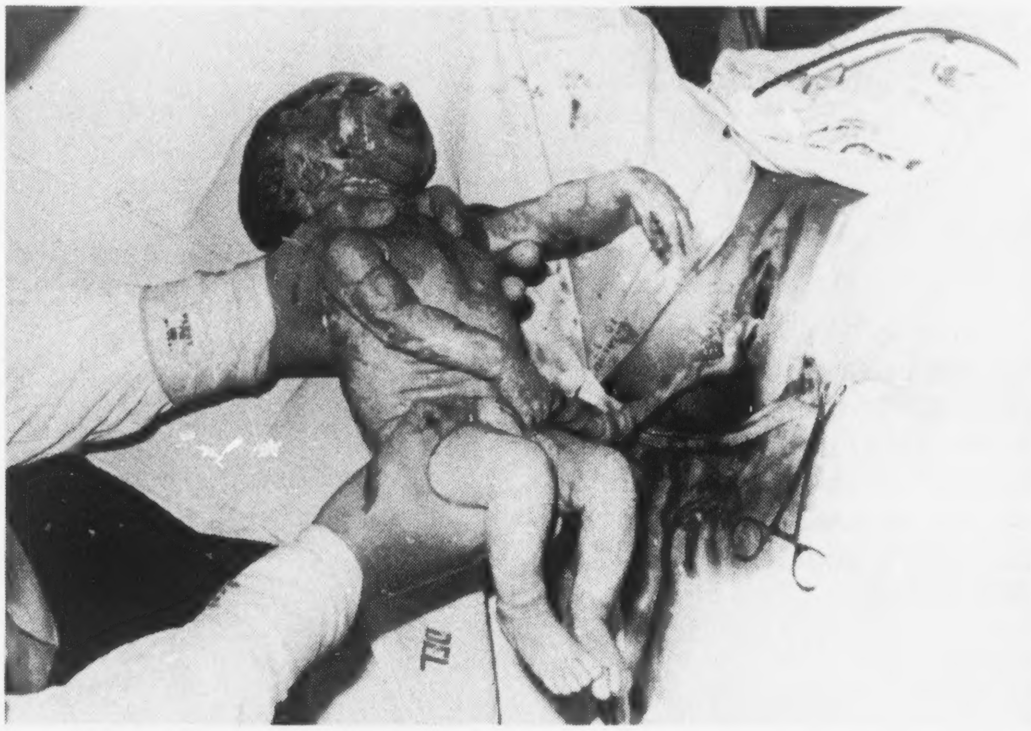


FIGURE 9. Delivery is complete. Hold the baby securely for he is slippery. He will be placed across his mother's abdomen to facilitate the flow of mucus and fluid.

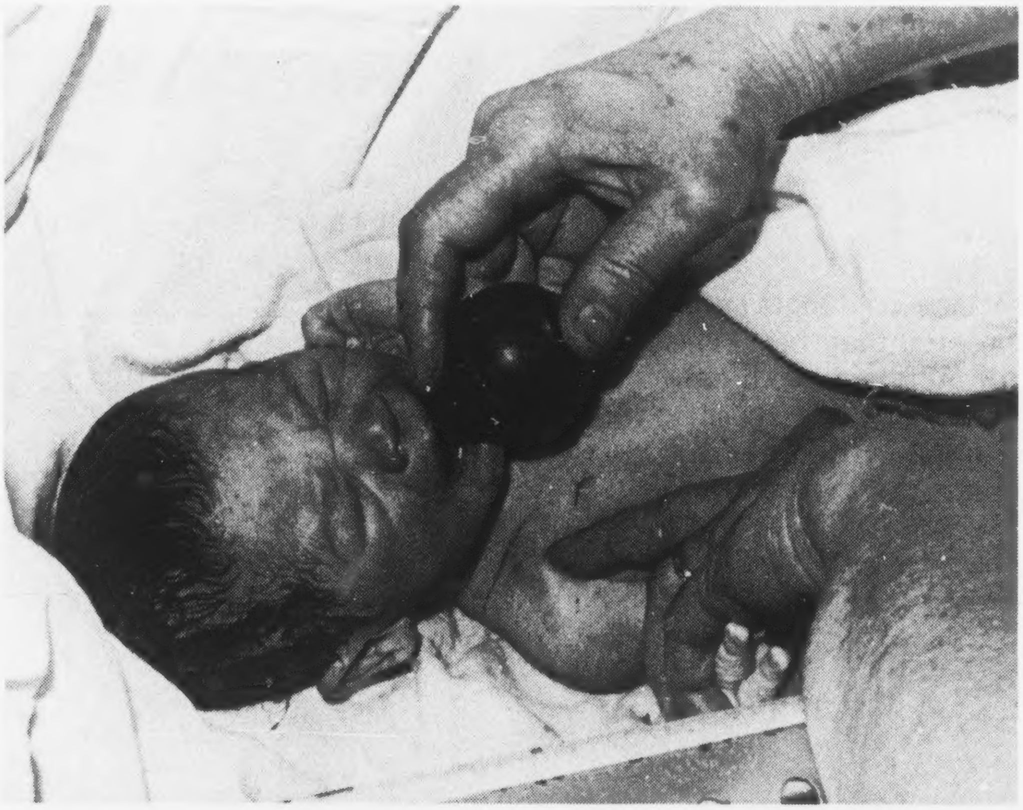


FIGURE 10. Continue aspirating fluids, and clearing of the air passage. If the baby is not breathing, stimulate and start artificial respiration.

CARE OF THE CHILD

The child is now on his own and should start to breathe. To safeguard the child, the squadmen should:

1. Turn the child on his side across the mother's abdomen. This will facilitate the flow of mucus out of his mouth.

2. Clear his air passage. Wipe his mouth inside and out with a gauze bandage (4 x 4). By placing another gauze compress (4 x 4) over your index finger and placing your finger in the child's mouth, gently clean out all foreign bodies and mucus.

All three of the above should be carried out in all deliveries whether the child breathes immediately or not.

3. If the child starts to breathe, your attentions should then be turned to the mother and the cord.

IF THE NEWBORN DOES NOT BREATHE -- If steps 1 and 2 above have been completed without the newborn breathing, the squadman must start some type of resuscitation.

4. Stimulate the child. This can be done by rubbing the child with your hand. Do not slap the child. You may also snap him on the bottom of his feet with your index finger. The child should be left on his side for this.

5. Use manual artificial respiration. Leave him on his side and aerate him by mouth-to-mouth breathing. This should be done once or twice. If the child is able to breathe on his own he will. If he does not:

6. Continue artificial respiration. This must be kept up until the child starts to breathe or until he is pronounced dead by a physician. Transport him as soon as possible.

CARE OF THE CORD

After the child is breathing, attention should be turned to the cord. The squadmen need to know the procedure for cutting the cord, as a safety measure when the mother must be moved under awkward conditions. Those who have tried to carry a new mother down three flights of stairs with a newborn balanced on her abdomen know the safety problem. There are instances when the child should be separated from the mother.

1. Tying the cord -- Place a sterile cord clamp or tie approximately six to nine inches from the baby's abdomen. Cord ties and clamps can be purchased through drug store or hospital supply companies. Each tie is 1/8" x 12". Ties are made of cotton and can be purchased sterile.

Approximately one inch further away from the tie or clamp, place another tie or clamp. When tying the cord, use square knots and put at least three knots in place.

2. Cutting the cord - Between these two clamps or ties, cut the cord with sterile scissors. This physically separates the living and breathing child from the mother.

Put the child in a soft blanket and place him in the care of some competent person. The child should be kept on his side with his head slightly lower than his body.

The emergency squad should check with local physicians as to the desired procedure to be carried out when cutting the cord in an emergency delivery.

THIRD STAGE – PLACENTAL

From the time the child is delivered until the placenta is delivered is the third stage of labor. The placenta usually appears within 30 minutes. See Figures 11 through 15. There will be one or two cups of blood delivered with the placenta. This is a normal amount.

After the placenta is delivered, it should be preserved in some type of container or wrapped in a newspaper. This must be kept and brought into the hospital with the mother and child, so that it can be examined to see if any particles have been left in the uterine cavity.

A sterile sanitary napkin can be placed in position at this time. Be sure it is sterile. Individually wrapped sterile napkins should be included in the O.B. pack.

NOTE: After delivery of the placenta, feel the uterus through the abdominal walls. If it feels relaxed and soft, and if there is excessive vaginal bleeding, the squadman should gently massage or "knead" the uterus. This will assist in the contraction of the uterus and retard the flow of blood. Continue to massage the uterus until it feels firm.

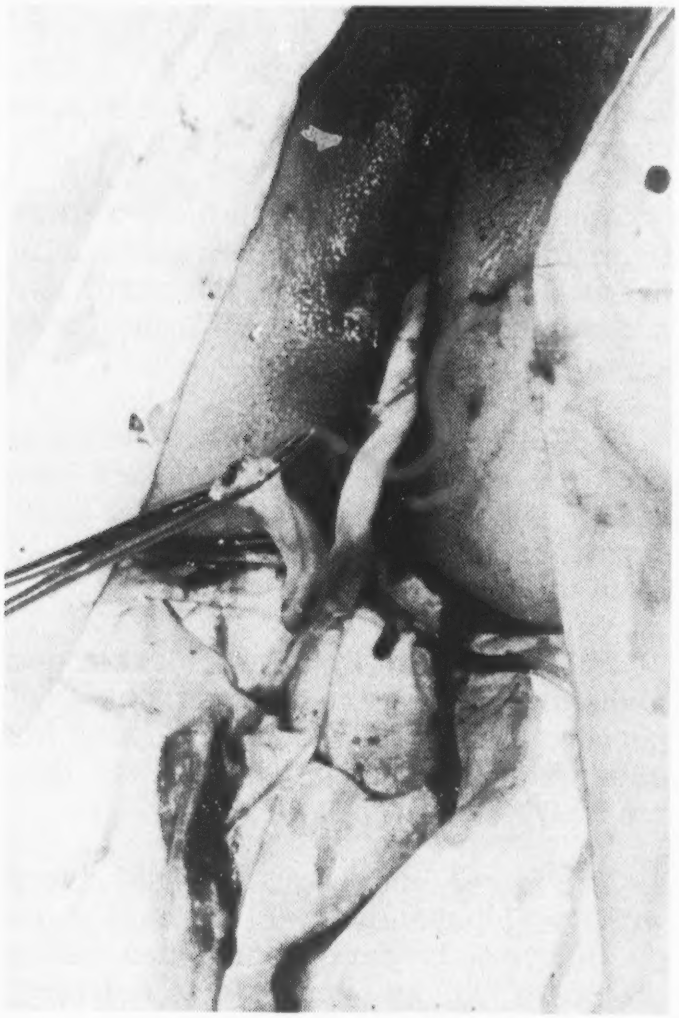


FIGURE 11. The cord has been clamped and cut. The placenta will be delivered by continued contractions of the uterus.

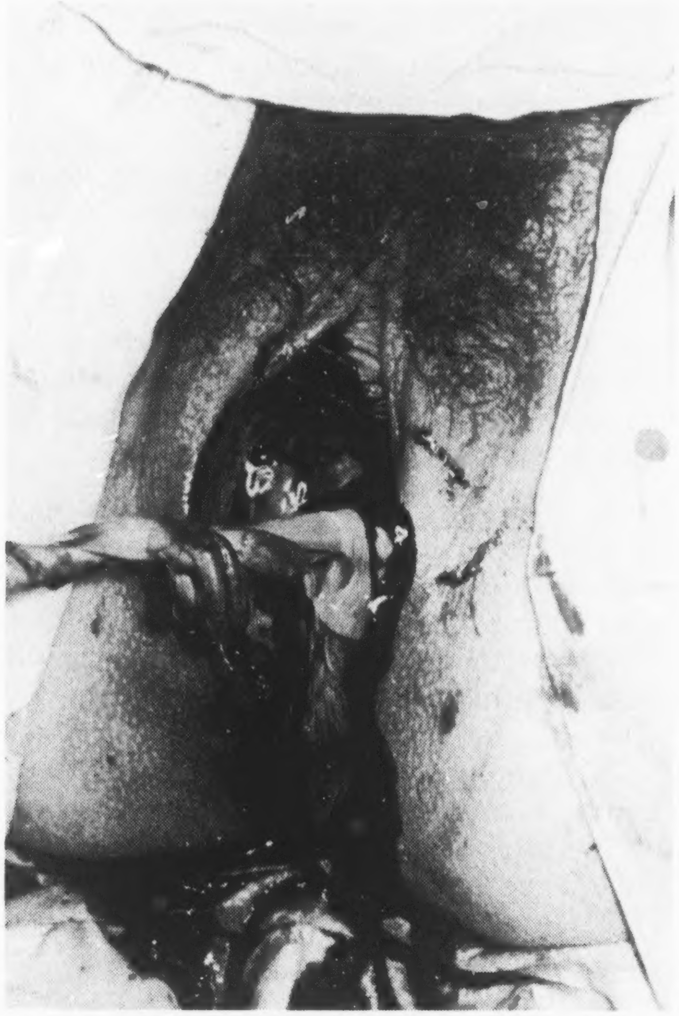


FIGURE 12. The appearance of the placenta accompanied with the normal flow of blood.

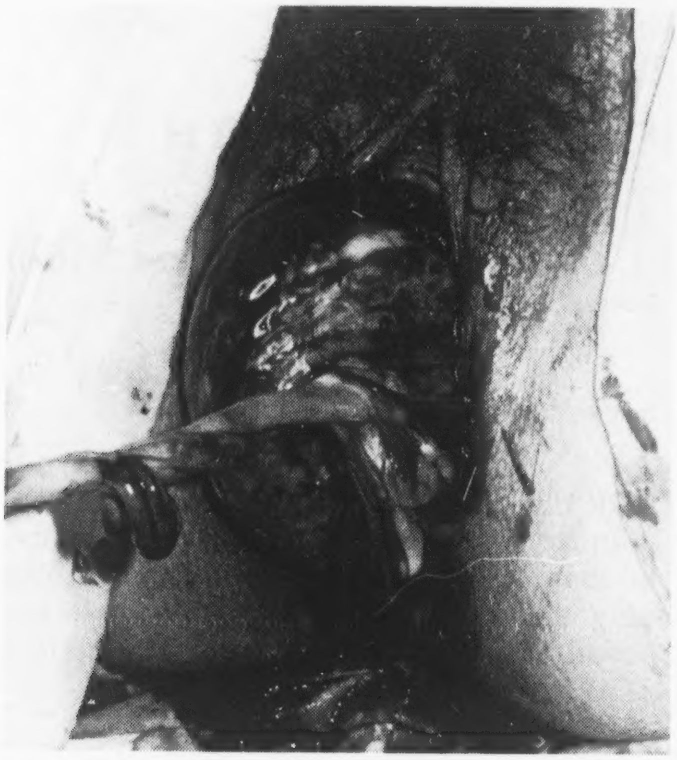


FIGURE 13. Continued delivery of the placenta. Do not pull on the cord.

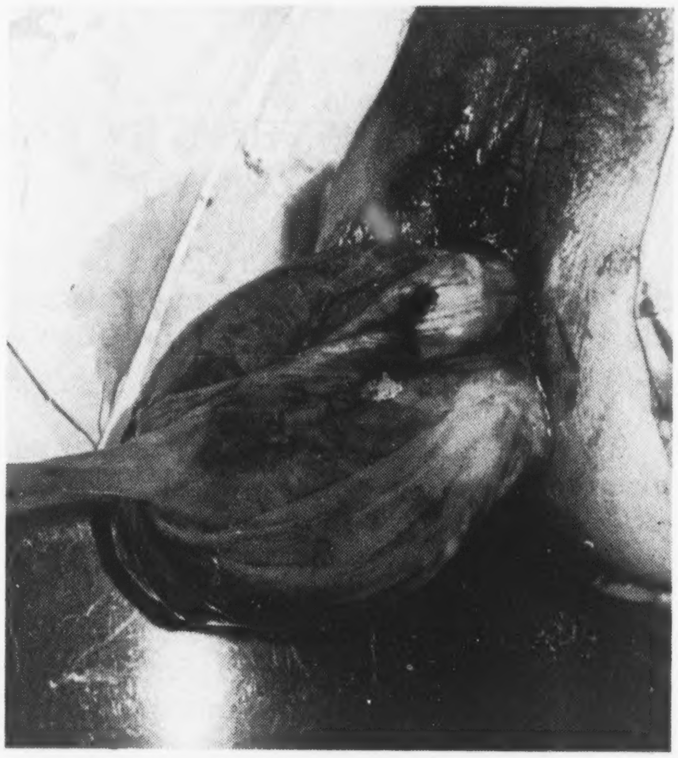


FIGURE 14. Delivery of the placenta. It must now be placed in a plastic bag on similar container to be taken to the hospital with the mother and baby.

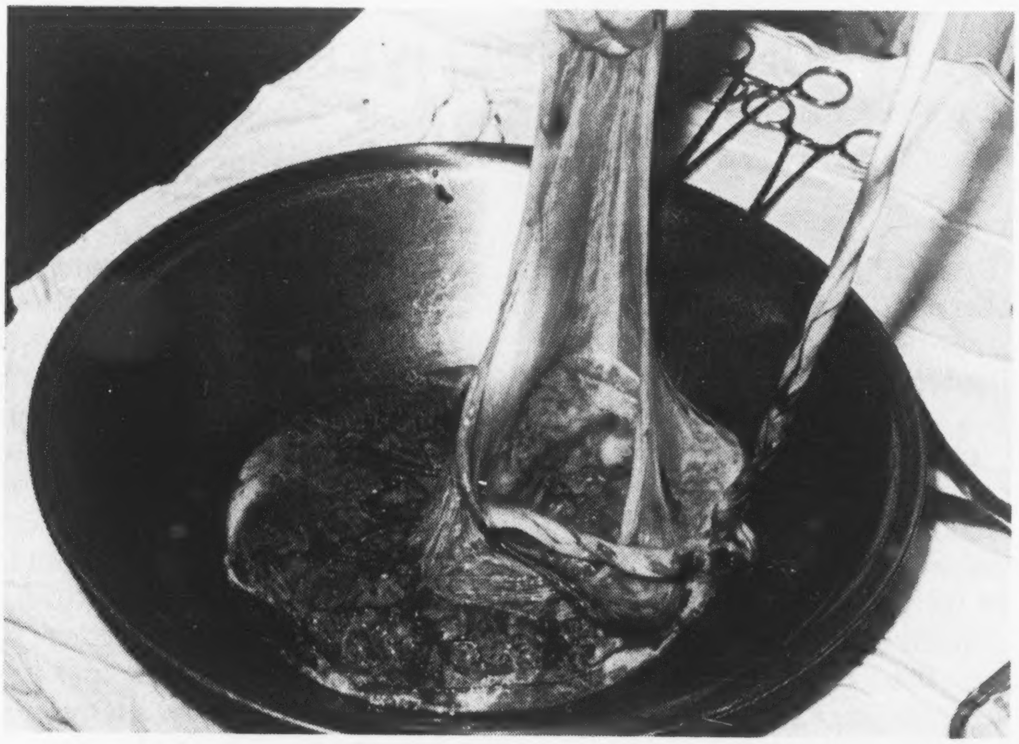


FIGURE 15. The placenta showing the amniotic sac which contained the baby and amniotic fluid during pregnancy.

FINAL STEPS IN EMERGENCY CHILDBIRTH

The mother and child must be in the hands of medical personnel before the squadmen leave them, for the following reasons:

1. The child must have a physical examination.

2. The mother must have a physical examination including the checking of her birth canal for lacerations.

3. The newborn's eyes must be cared for, to prevent any serious eye infection. (This is a state law in Ohio.) Silver nitrate is usually used and this function is to be performed only by the experienced and trained squadman; usually it is done by a physician.

4. The cord must be checked by competent medical personnel.

5. Baby and mother must be observed for a period of time.

If the physician should ask the squadman to make out the birth certificate, he may do so. Many times the physician may ask that this be done because the squadman was present at the actual delivery.

Birth certificates can be obtained at the local county health office. They must be made out as soon as possible after the birth and be filed with the proper registrar in the county health office.

UNUSUAL DELIVERIES

DEFINITION

The term "Breech", in connection with childbirth, refers to the birth of the infant in a reverse position, as contrasted with normal head-first delivery.

In normal childbirth, the child will usually start to breathe as soon as his chest is exposed, or shortly afterwards. Because of the nature of the breech type of birth, the child's chest is delivered before his head. It is impossible for the child to take in air, as his air passages are blocked; his head is still within the vaginal canal.

SQUADMEN'S CARE

As soon as the squadman finds that it is going to be a delivery in a breech position, he must be ready to support the child. This can be done by letting the child rest on the squadman's hand and arm, thus allowing the infant's legs to straddle the squadman's arm.

The legs, hips, stomach, and chest will be delivered at this point. Sometimes it will be harder for the mother to deliver the head, and in more severe cases, the delay is quite long. If this happens, the child may suffocate, as the result of a poor air passage.

An air passage may be created by the squadman supporting the body of the infant with one hand and inserting the index and second finger of his other hand into the vaginal canal in such a way that the palm faces the baby. He should run his fingers around the child's neck until the chin is found. At this point the two fingers should be run between the child's chin and the vaginal canal. As the child's nose is reached, the squadman should separate his fingers enough so as to run one on each side of the child's nose. When in this position the squadman's fingers should be pushed away from the infant's face, in turn, facilitating a good air way. The squadman should keep his fingers in this position until the entire head is delivered.

This is the only time the squadman should touch the vaginal area. The squadman should have sterile gloves on for this procedure.

OTHER CHILDBIRTH EMERGENCIES

On arrival, squadmen may find that the cord, a foot, or a hand is protruding from the birth canal. Transport this mother at once, taking special care not to injure the prolapsed part. Do not try to replace the prolapsed part in the vaginal canal!

If a hand or foot is protruding, cover it with a sterile towel or as clean a piece of material as is available.

If the cord should be protruding, the child may be in danger. This danger is caused by the cord being under direct pressure due to its position between the head and the birth canal. While the cord is in this position, the child might not be receiving an adequate amount of blood and oxygen.

SQUADMEN'S CARE

Transport this mother at once! In case the cord is protruding, place the mother on her back with her hips elevated on two or three pillows or folded blankets. This will cause the child to drop a little into the uterus. If the mother can be maintained in a knee-chest position, balance supported by squadman, it is preferred to elevated-hip position. However, this is a very difficult position to maintain during transport, and special precautions must be taken to safeguard the mother if this position is used. These positions will relieve some of the direct pressure pinching the cord.

ABORTION OR MISCARRIAGE

DEFINITION

This is the giving off of the membranes and the unborn child before the child is able to live on its own. This usually occurs before twenty-eight weeks of pregnancy have passed. Such an abortion or miscarriage can take place any time between conception and the time just before the child is able to live on his own. Although the outward symptoms may vary, the following symptoms will be present.

SYMPTOMS

1. Fast pulse
2. Perspiration
3. Pallor (pale skin)
4. Weakness - inability to stand
5. Cramping pain in the abdomen
6. Moderate to severe vaginal bleeding
7. Discharge of large or small particles from the vaginal canal

In other words, there will be all the symptoms of shock, plus, in most cases, bleeding from the vagina.

SQUADMEN'S CARE

1. Place victim in shock position.
2. Conserve body heat.
3. Squadmen may moisten the patient's lips if she requests it.
4. Do not touch the vaginal area, as the victim is prone to infection.
5. Squadmen may put sterile towels or vaginal pads (sanitary napkins) at the vaginal opening.
6. Keep any particles that are discharged and take them to the hospital with you, since this fleshy material may have form.

EMERGENCY BAPTISM OF THE FETUS OR EMBRYO

A miscarried fetus or embryo, no matter how small, must always be baptized -- absolutely if certainly alive, conditionally if doubtfully alive. Putrefaction or advanced general decomposition is the only certain sign of real death. Break the membranes, or open the blood clot surrounding the embryo. Immerse it in a pan of water making sure the water contacts the fetus itself. Then, while moving it about in the water so that there will be a washing or flowing or "baptizing," say the words of conditional baptism: "If you are capable, I baptize you in the name of the Father, and of the Son, and of the Holy Spirit." Finally, remove it from the water.

EMERGENCY BAPTISM FOR DYING INFANTS AND BABIES

Any dying child who is below the age of reason must be baptized. If you are not absolutely sure the baby was baptized at all, or correctly and validly baptized, and a member of the clergy cannot be had in time, baptize without delay. No dispositions, of course, are required of the child, since it has not attained the age of reason. The same is true also for those mentally deranged from birth, since they are equivalent to infants. Have one witness if possible without delay. While pouring water on the forehead, say: "I baptize you in the name of the Father, and of the Son, and of the Holy Spirit."

CHAPTER XXIV

USE OF BACKBOARDS

INTRODUCTION

The backboard is a versatile tool. Its primary purpose is the immobilization of fractures of the neck and back. But this rigid board is also ideal for moving victims of other conditions such as fractures of the pelvis or both legs.

To carry a large unconscious patient down three flights of stairs is a real job. Strapping the patient securely to a backboard makes the job much easier.

After using the backboard for a short time, squadmen will recognize many other types of situations in which it is useful.

Victims should be moved onto a backboard by the method known as "logrolling".

LOGROLLING

DEFINITION

Logrolling is the turning of a victim's body by several people working in unison. Its purpose is to protect a victim who must be moved onto (or off of) a backboard or stretcher, when his back or neck may be injured.

The procedure has been used for many years in hospitals. It should always be used by squadmen on accident victims with suspected neck and back injuries.

Logrolling is also a wise practice whenever squadmen are preparing to transport an unconscious victim.

Figures 1 through 12 and their captions show logrolling procedures. The position of the squadman's hands should always be, as nearly as possible, that shown in the pictures. When a victim is to be removed from a car or truck, these same hand positions can be used.

PREPARING TO ROLL

Emergency care should be given to the victim before he is logrolled.

After emergency care, when you are ready to move the victim onto a backboard, establish on which side he is to be rolled: it should be his least injured or non-injured side. Next, raise the victim's arm, on the side onto which he is to be rolled, above his head. (See Figure 1.)

Figures 1 through 19 – Courtesy Sharon Twp. F.D. – Worthington, Ohio

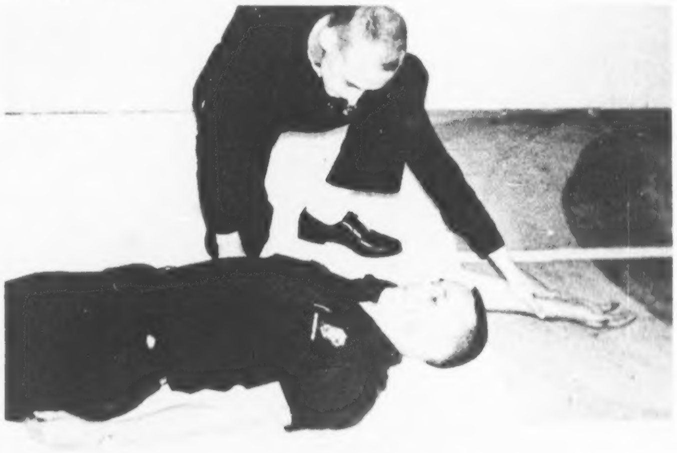


FIGURE 1. Raising the victim's arm prior to rolling. In this case he will be rolled onto his right side.

POSITION OF HANDS

The exact position of each squadman's hands on the victim is very important in logrolling.

1. The top man's top hand is to be under the neck, supporting the head. His bottom hand grasps the clothing (or skin) at the shoulder (See Figure 2.)

2. The center man's top hand is to be around the victim's distant arm and grasping the clothing. His bottom hand grasps the clothing at the belt region.

3. The bottom man's top hand grasps the victim at the hip region. His bottom hand grasps the distant leg at the calf.

ROLL

At a signal from the top man, all three roll the victim toward them. (See Figure 3.) Note that four of the six hands of the squadmen are grasping the trunk of the victim's body. Also note that the victim's head is supported by the top squadman. All squadmen should be on the same knee.

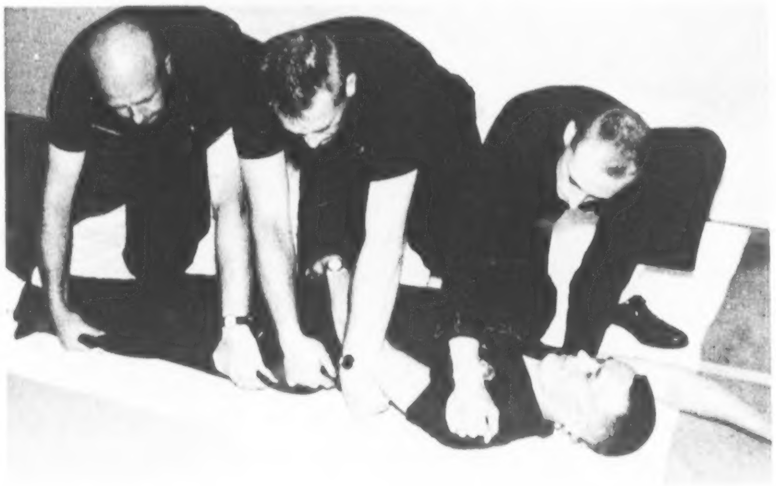


FIGURE 2

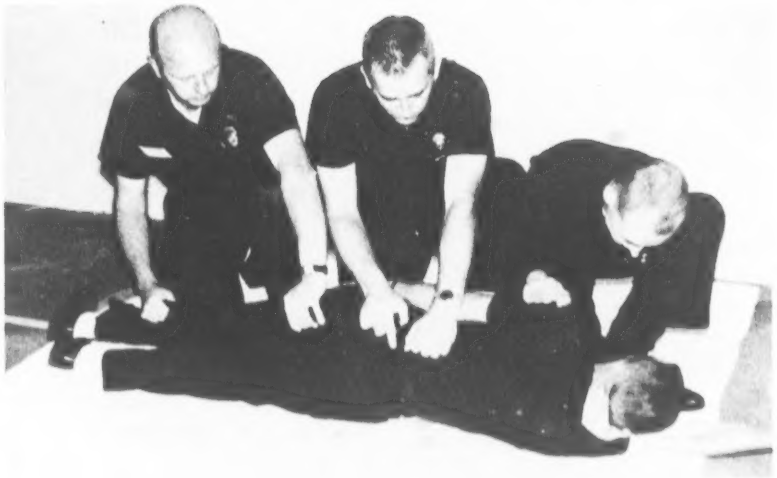


FIGURE 3

Figure 2 shows the location of each squadman's hands on the victim before logrolling. In Figure 3 the victim has been logrolled onto his side.

PLACING THE BOARD

While the victim is held on his side, the board is placed flat on the ground or floor next to the victim. (See Figure 4.)

Again on a signal from the top man, the victim is lowered on the board. His arm is returned to his side.

SLIDING THE VICTIM

The victim usually is centered when placed on the board. If he is not centered on the board, he can be slid over by the rescue team, working in unison. While the man who placed the board holds it, the other three squadmen remain where they were and place their hands on the victim's body, in the same positions, but on the opposite side. (See Figure 5.)

At the signal of the top man, the victim is slid over with a gentle, even motion.

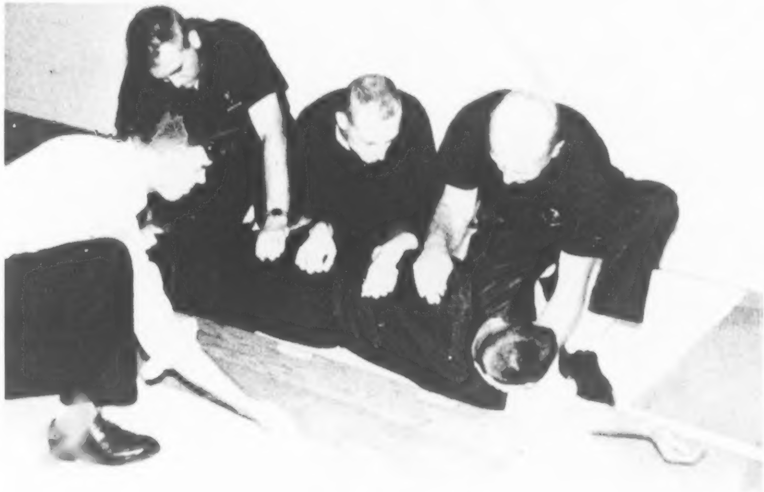


FIGURE 4

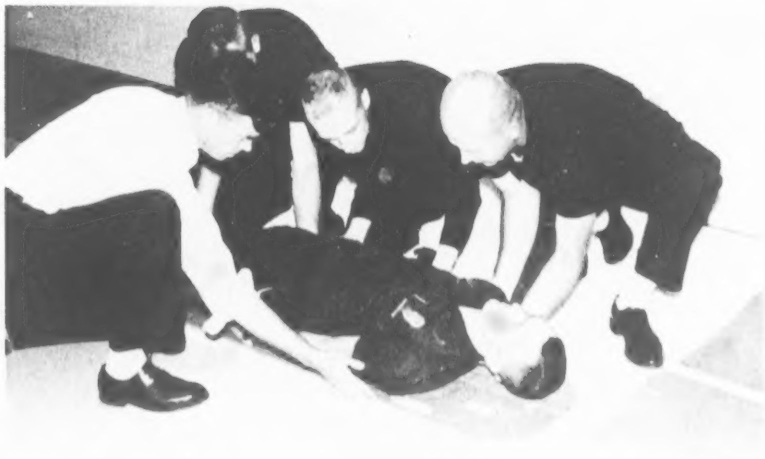


FIGURE 5

A backboard is placed behind the victim (Figure 4). After he is lowered onto the board he can be slid gently toward the center if necessary (Figure 5).

BOARD WITH FOOTREST

If it is determined a footrest will be needed on the backboard, insert it prior to logrolling the victim.

The squadman who will place the board should measure the board by placing the board and footrest as shown in Figure 6. The board is then placed on the floor and the victim is logrolled as previously described.

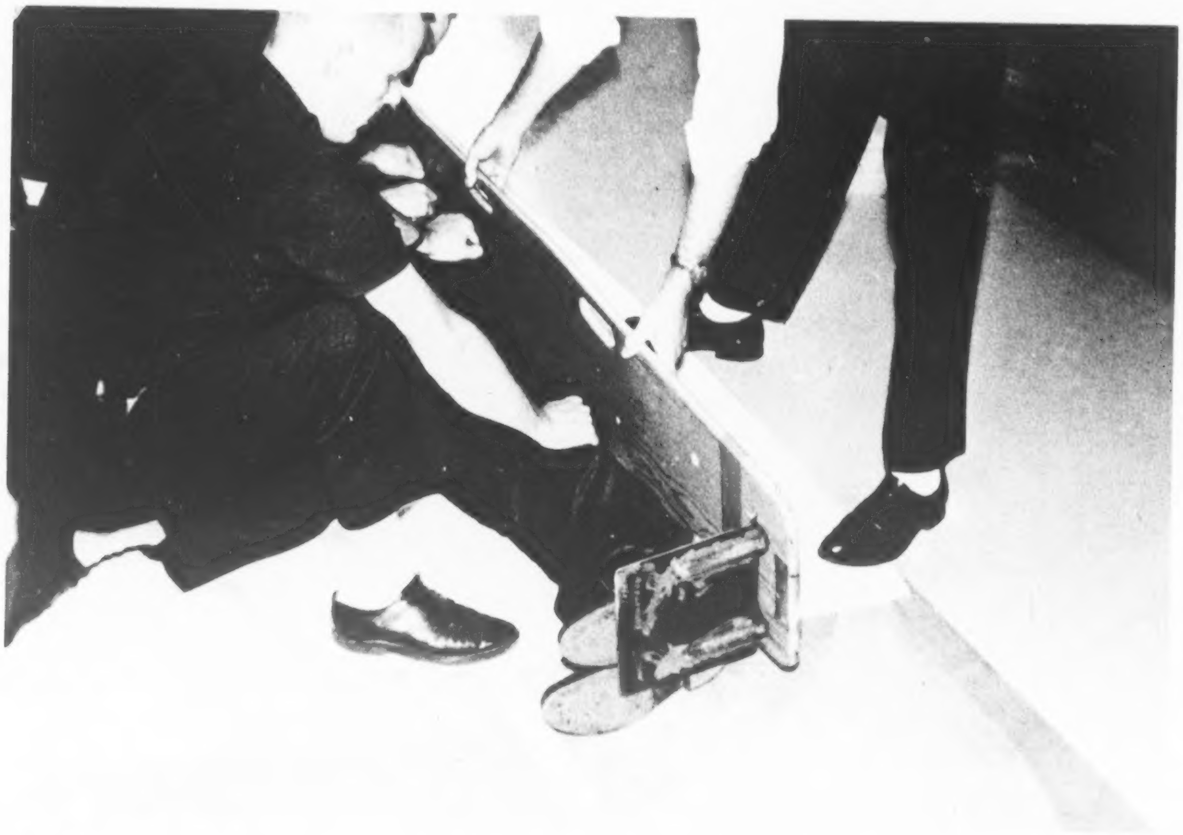


FIGURE 6. If a footrest will be needed, place it against the victim's feet with the backboard in place.

POSSIBLE NECK INJURY

If a neck injury is suspected, one squadman must attend the head and neck at all times until it is immobilized.

Figures 7 and 8 show the proper way to logroll a neck injury.

Note that the squadman caring for the neck is applying slight traction, supporting the chin and keeping the nose in line with the "belly button" at all times. Also note that the man at the shoulder uses only one hand during this procedure. The man caring for the neck should give all signals. The victim's neck should then be immobilized with a blanket-roll splint as shown in Chapter XVIII.

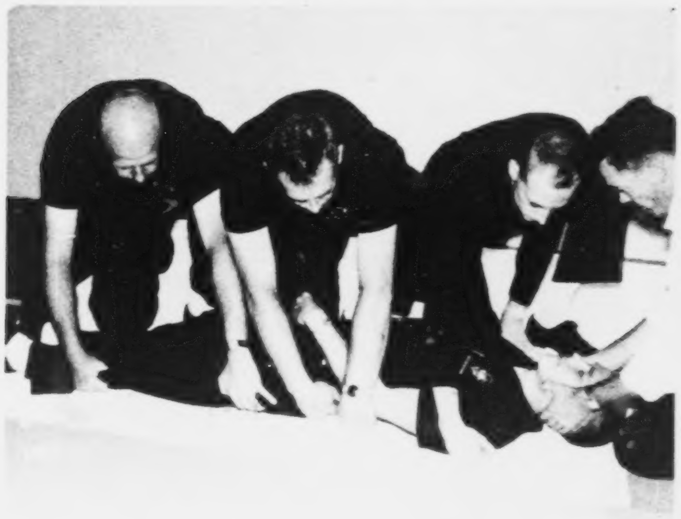


FIGURE 7

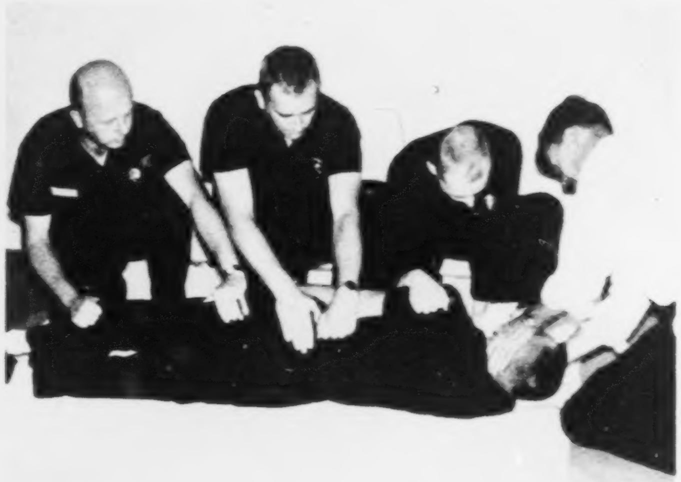


FIGURE 8

Four men logroll a suspected neck-injury victim.

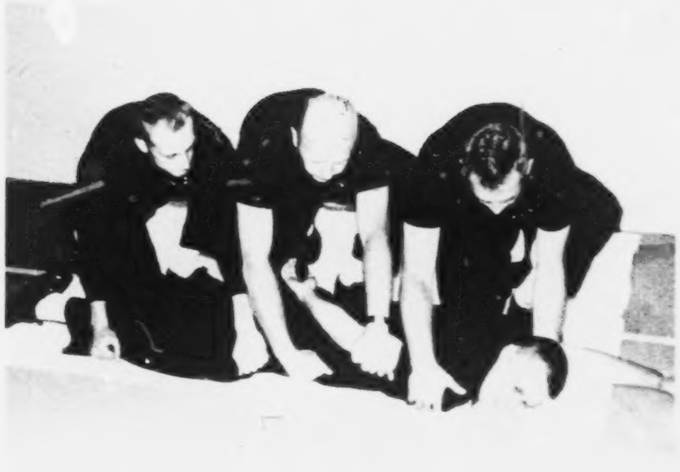


FIGURE 9

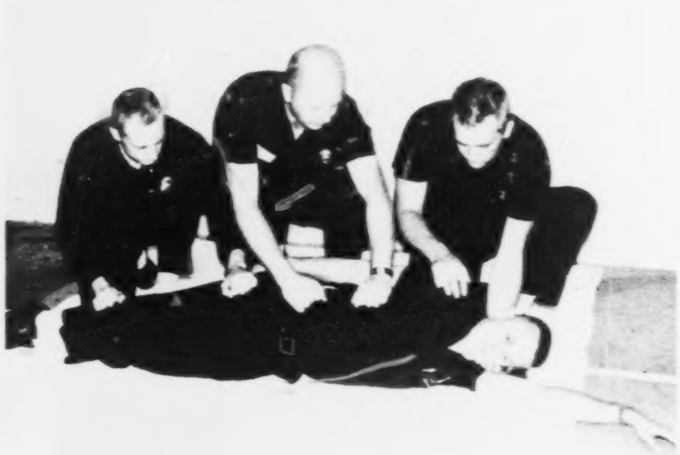


FIGURE 10

Squadmen's hands are placed for logrolling a victim face down (Figure 9). Then the victim is rolled onto his side (Figure 10).

ROLLING VICTIM FACE DOWN

When a victim is found face down and should be transported that way (severe bleeding at the face, secretions and mucus from the mouth, vomiting, etc.) The procedure is much the same.

Figure 9 shows the placement of the hands for this procedure.

Figure 10 shows the same victim on his side.

Figure 11 shows the placing of the board.

Figure 12 shows the victim, face down on the board.

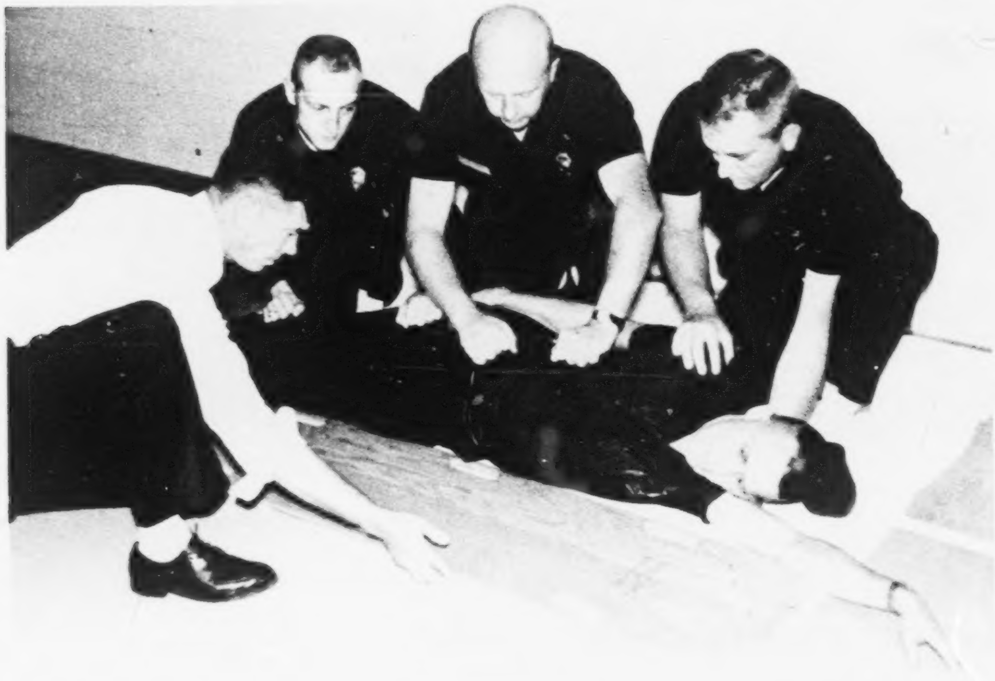


FIGURE 11

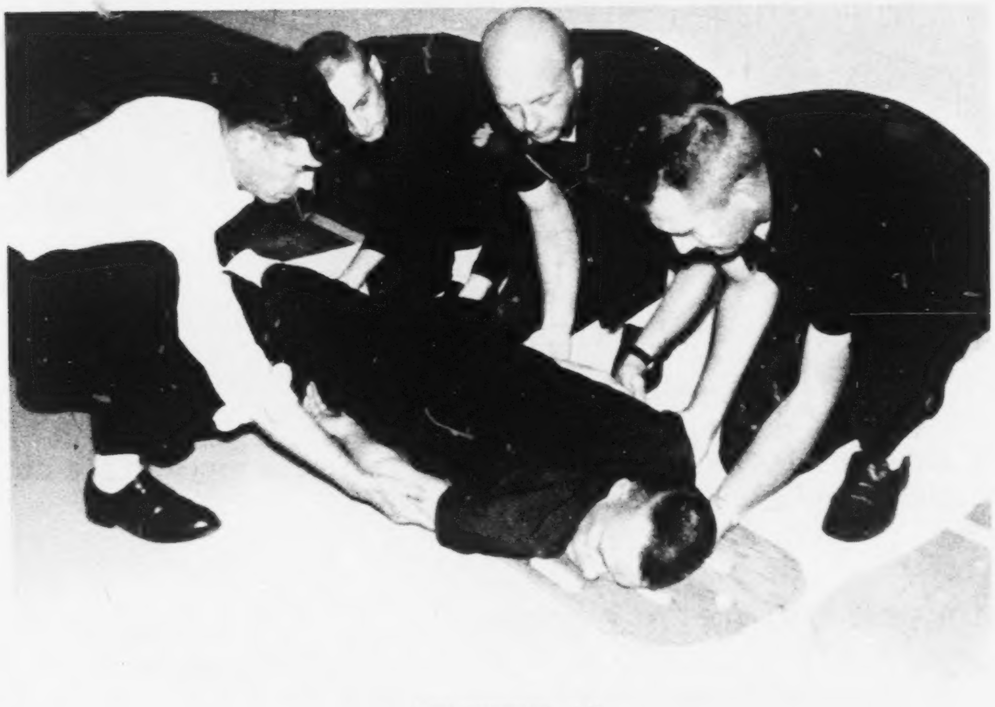


FIGURE 12

The board is placed in front of the victim (Figure 11). After he is lowered to a face-down position he can be slid gently to the center of the board (Figure 12).

HANDLING OF BACKBOARDS

The following series of pictures (Figures 13 through 20) illustrate how to use backboards.

Specifications for two backboards, child and adult sizes, can be found in Chapter II of this manual.

STRAPPING A VICTIM TO A BOARD

If a victim must be carried for some distance on a backboard, he should be strapped to it.

Placing Straps - The positions of the three straps on the victim are most important.

1. The bottom strap must be placed around the board and around the victim just above his knees. This will prevent him from raising his legs off the board.

2. The middle strap must be placed around the board, and across the victim's hip region. His hands should be at his sides; the strap passes over his wrists.

3. The top strap must be placed around the board and across the victim's chest region, just below the shoulders.

All three of these strap positions can be seen in Figure 13. Note the straps do not go through the holes in the board, but around the board. The straps would not be located properly if they were put through the board holes.

Securing Feet and Head - If the victim must be carried up or down any distance, a footrest must be put in place and his feet must be tied to it with a cravat. The victim's head can be kept secure with a cravat. Figure 14 shows how the cravats are tied.

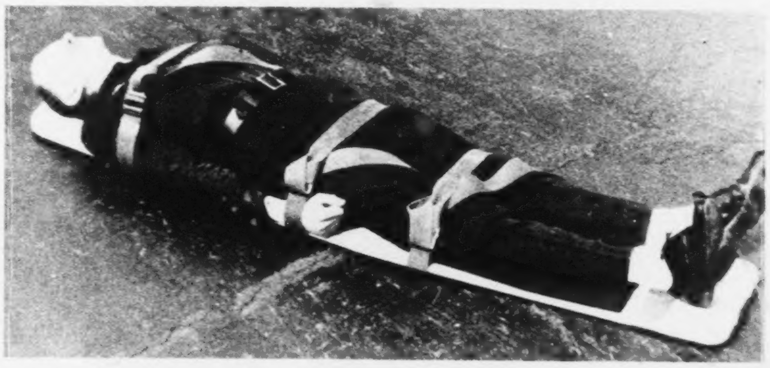


FIGURE 13

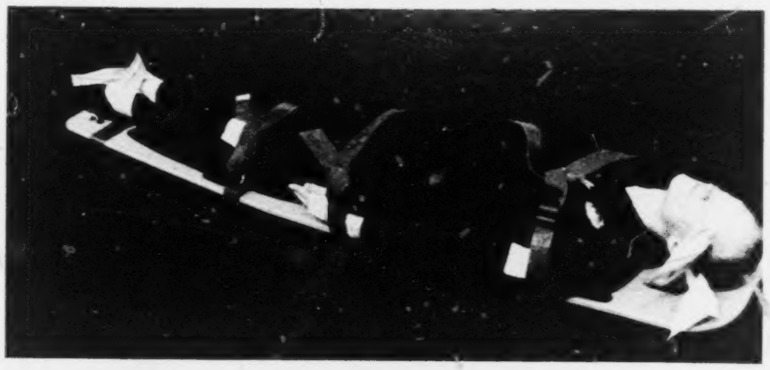


FIGURE 14

Figure 13 shows proper strap placement. The bottom strap passes just above the knees; the middle strap passes across the thighs and over the wrists; the top strap passes across the upper chest. Figure 14 shows proper placement of straps, footrest, and cravat bandages.

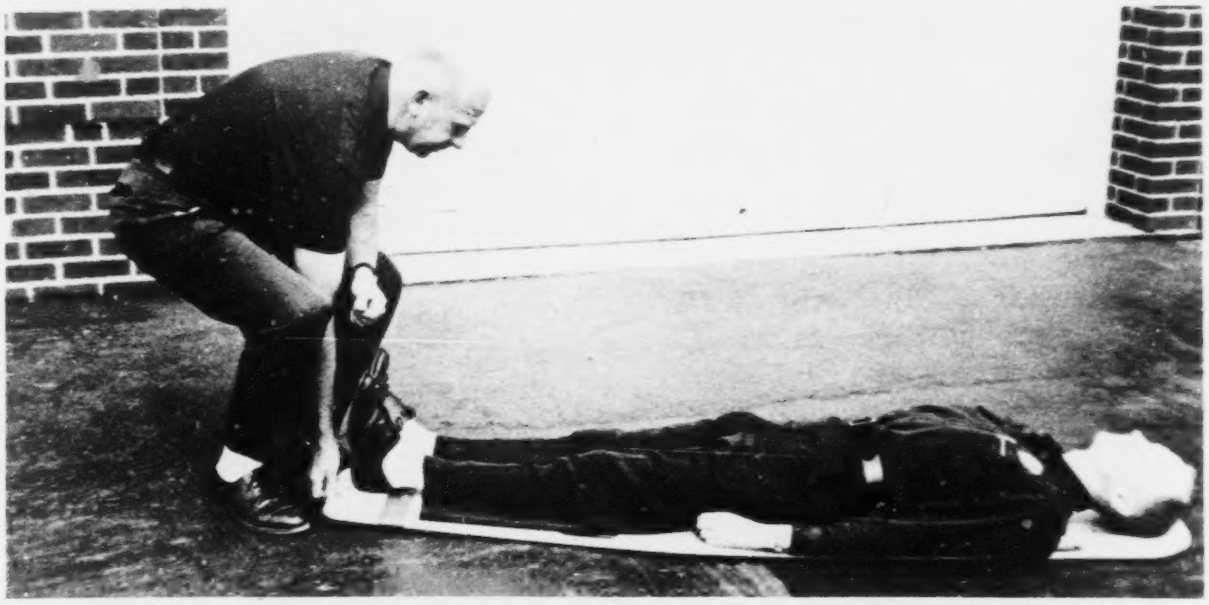


FIGURE 15. Squadman places one hand on board handhold.

RAISING THE BOARD

To raise a backboard, one squadman places four fingers of one hand into the handhold in the bottom of the board. (See Figure 15.) He then lifts the board and places it on one foot. (See Figure 16.)

Then he takes hold of the board with both hands, bends his knees, and lifts with his legs, not his back. He lifts the board just to his knees. (See Figure 17.)

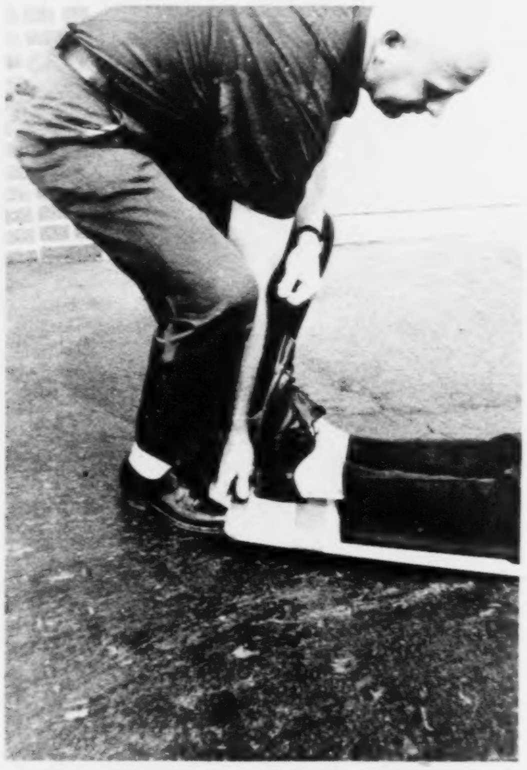


FIGURE 16. Squadman places board on his foot.

The top man places himself at the top of the board. He stoops, places each hand on one edge of the board, and slides his hands along the board toward him until they touch the ground. (See Figure 17.)

He then straightens his legs and lifts with his leg muscles, not his back. If both men keep their arms straight, the board can be carried easily. (See Figure 18.) Squadmen should not bend their arms while carrying a patient on a backboard, as it is very tiring.

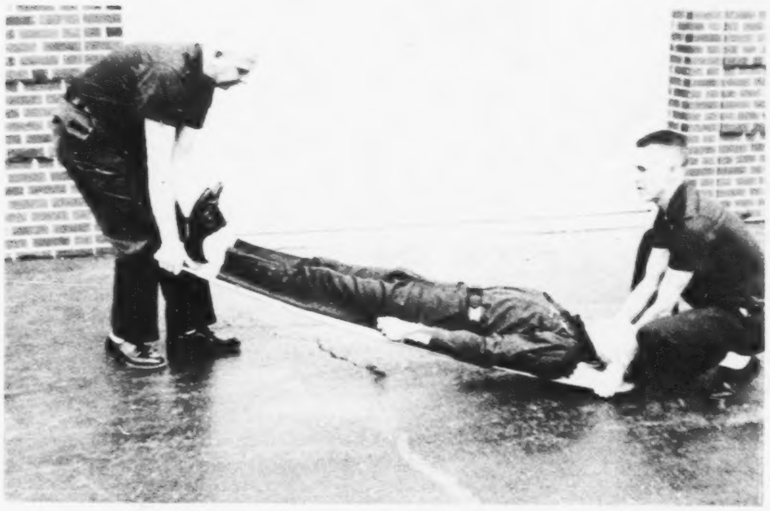


FIGURE 17

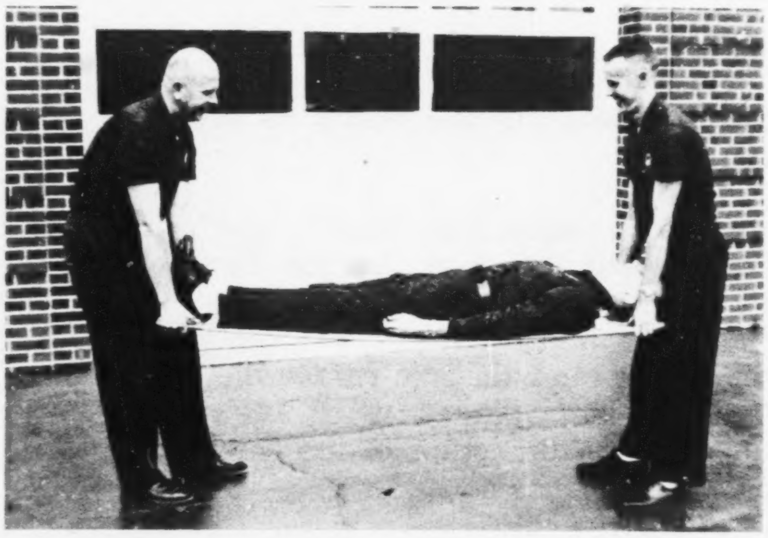


FIGURE 18

Figure 17 shows the proper first step in raising the board. Figure 18 shows the proper way to carry the board.

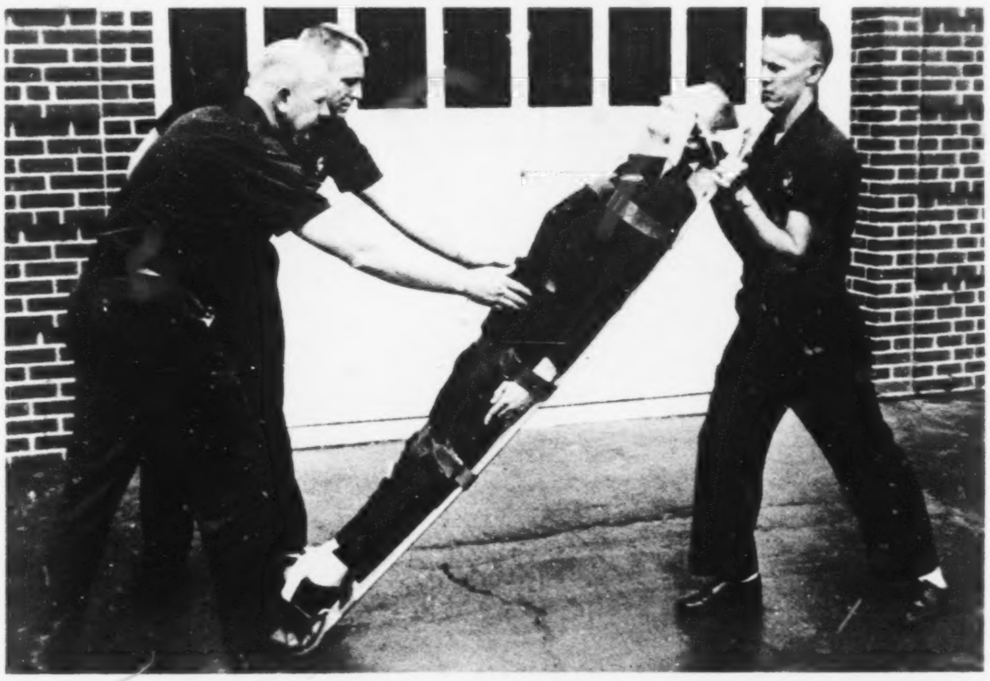


FIGURE 19. Squadmen raise the victim to a vertical position.

Raising Victim's Head - If the victim must be carried in a vertical position while strapped to the board he must be raised properly:

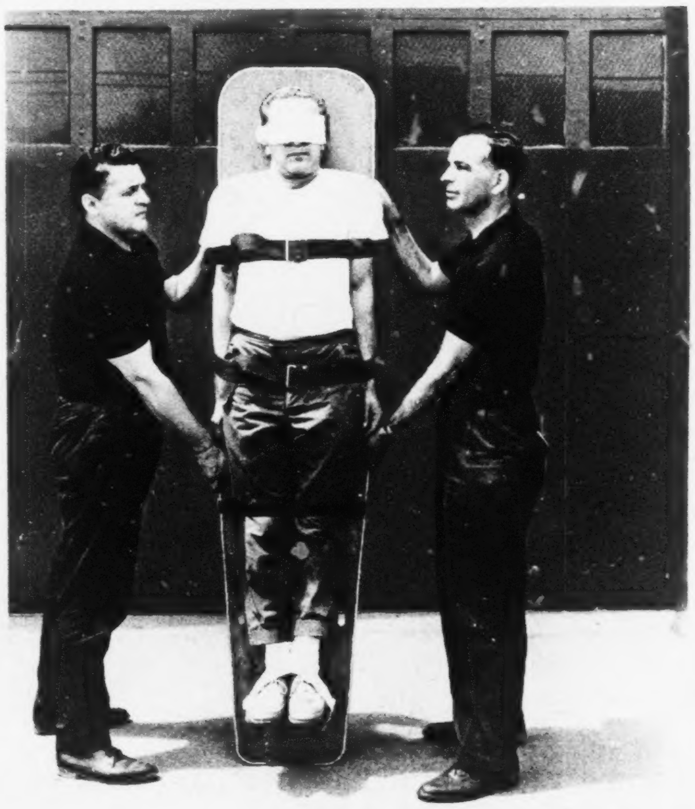
1. After the board is lifted to the normal (horizontal) carrying position, the foot end of the board is lowered again.

2. Two squadmen then "foot" the board; that is, each braces it with a foot.

3. The top man then raises the board to his chest, places it on his chest, changes the direction of his hand position, and pushes away.

4. The bottom two men then receive the board. (See Figure 19.)

The victim who is properly secured to a backboard can safely be raised to a vertical position using this procedure. He will not slide off or fall away from the board (See Figure 20.)



Courtesy Yorkville Vol. F.D.

FIGURE 20. The victim is secure in a vertical position.

CHAPTER XXV

MOVING AND HANDLING THE VICTIM

INTRODUCTION

After emergency care and life support measures have been provided, the victim must be moved to the ambulance for transport to a medical facility. Proper movement and handling will prevent aggravation of the victim's condition and will provide the greatest degree of comfort to the victim and the emergency personnel.

The location, environment, and the victim's condition will dictate the method and equipment to be used. The emergency personnel must size-up the situation, exercise his initiative, and rely on past experiences in every case before moving the victim.

(In many of the following procedures assistance from family members or bystanders must be secured to place and position backboards and cots, and to assist in lifting the victim. They must be instructed in "what to do," and "to do it" only when directed by the man in charge.)

FROM A BED

In many of the ambulance runs to a residence, the victim will be found in bed. The following procedures have proven to be very effective, especially when moving those who are seriously ill, aged, or very large. See Figures 1 through 5.

Figures 1 through 20 – courtesy: Groesbeck F.D.

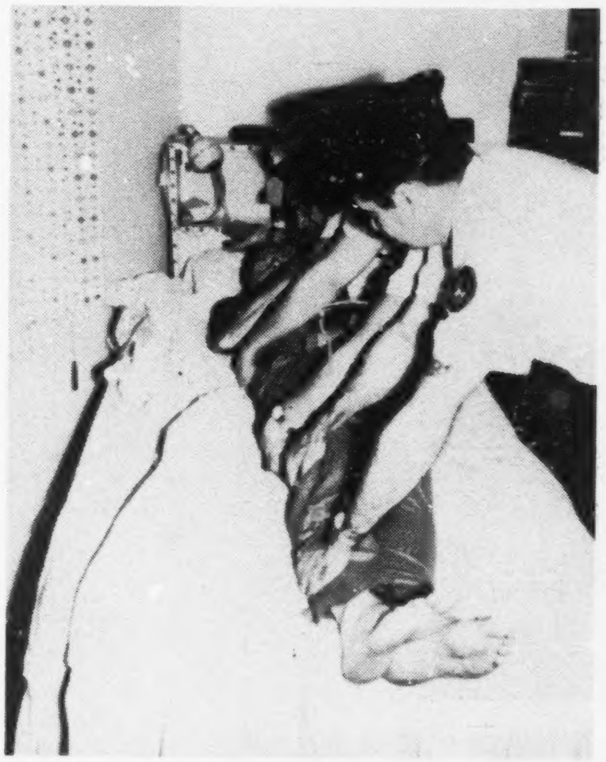


FIGURE 1. The victim is logrolled onto his side.

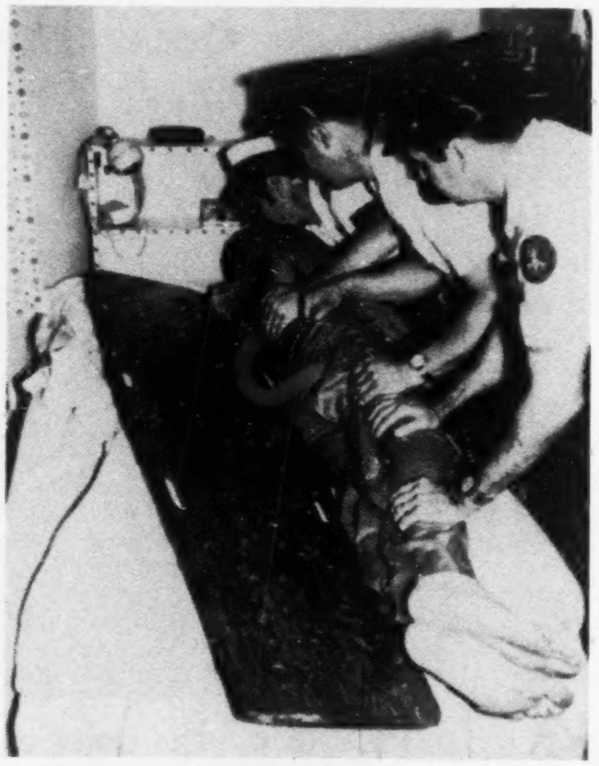


FIGURE 2. The backboard is placed in position.

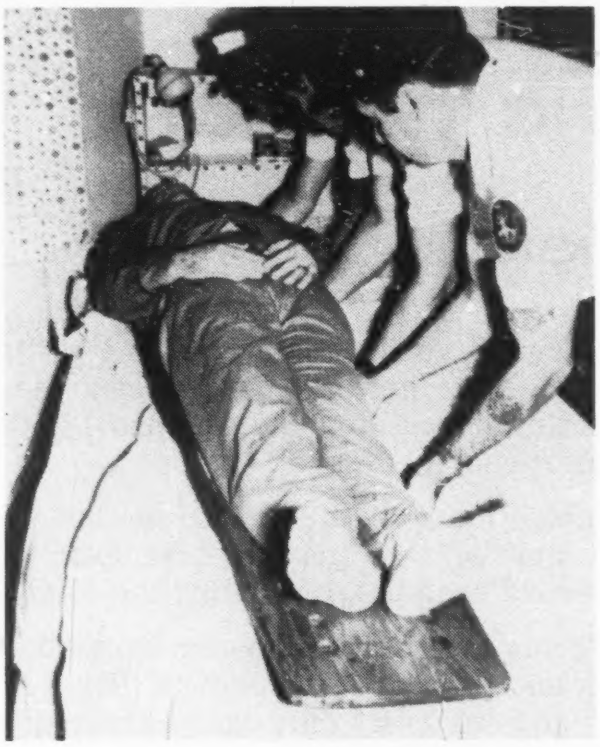


FIGURE 3. The victim is lowered onto the board. By sliding the board the victim can be moved to any position with ease.

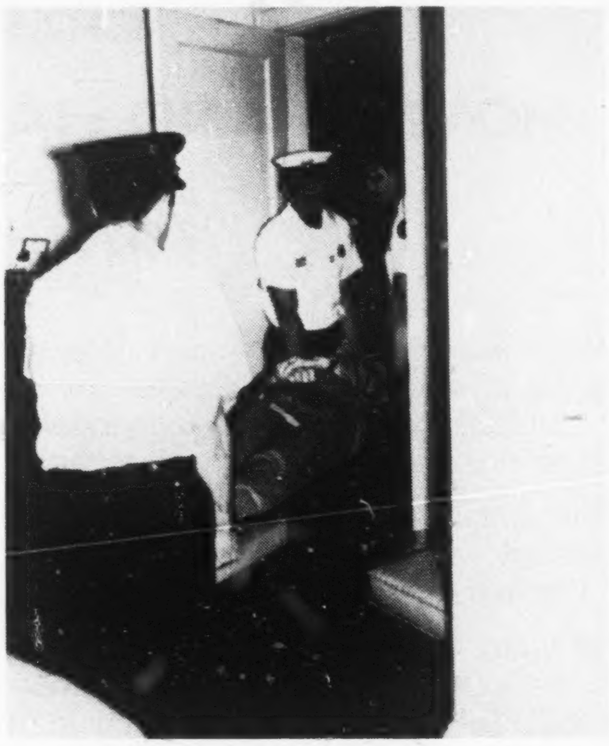


FIGURE 4. The ambulance cot could not be taken to the bedroom because of a narrow hallway that ended with the bedroom door at a right angle. With the victim on a backboard he is easily moved through the door and hall.

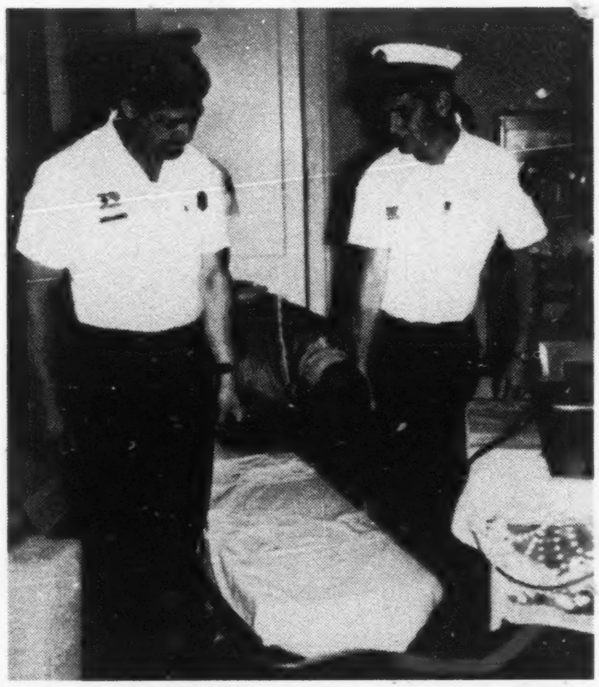


FIGURE 5. The cot is placed at the hallway exit to accept the victim on the backboard. The board may be left in place or removed depending upon the victim's condition and/or comfort.

FROM A COUCH

It is not uncommon to enter a residence and find the victim on a couch. To lift the victim from the couch use the three man rise. Making sure that the area behind you is clear, lift the victim to your standing position and take two steps backwards. The cot is then moved in between the squadmen and the couch and directly under the victim. Lower the victim to the cot. See Figures 6 through 9.

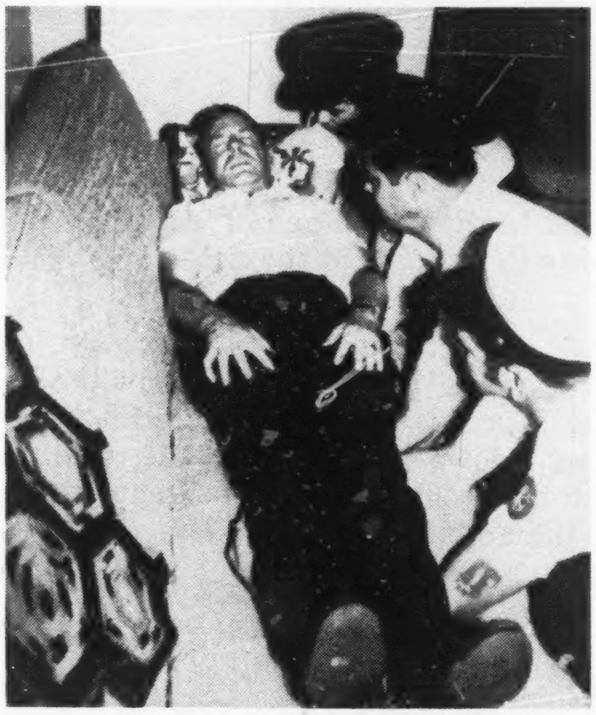


FIGURE 6. Clear the area behind you of coffee tables, chairs, etc. Prepare to lift the victim using the three man raise.

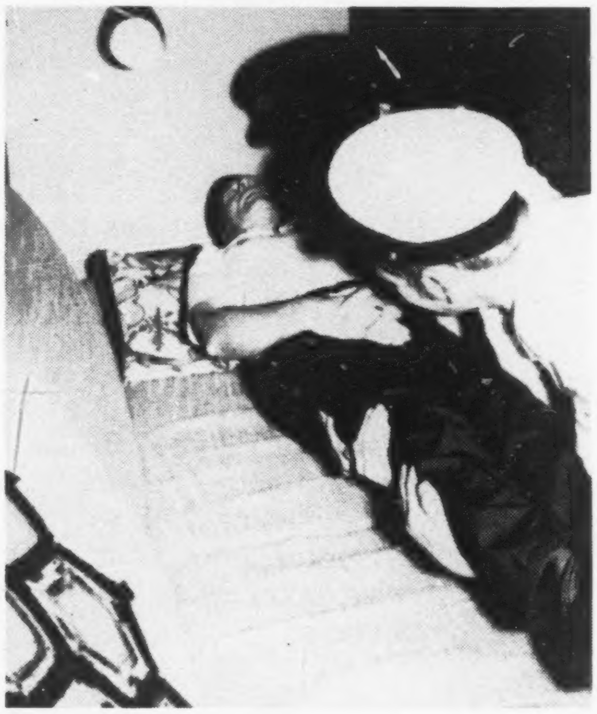


FIGURE 7. The victim is lifted from the couch and raised in unison.

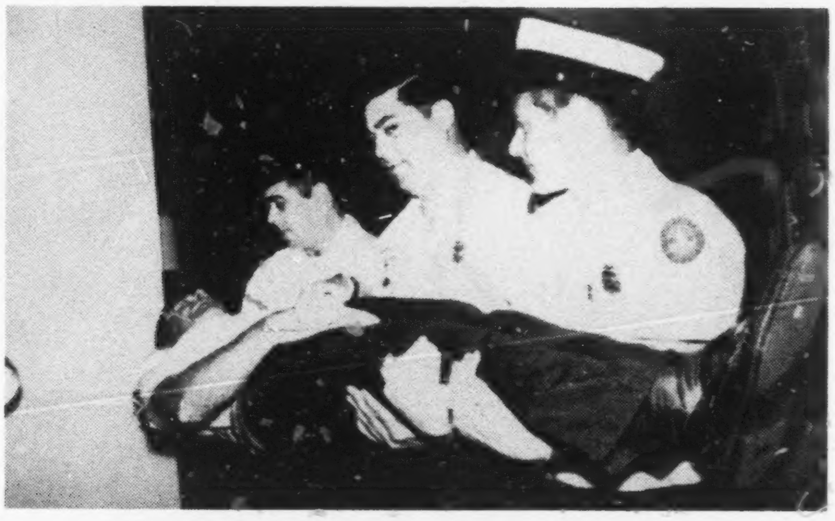


FIGURE 8. Lift the victim until you are in the standing position, take two steps backwards.

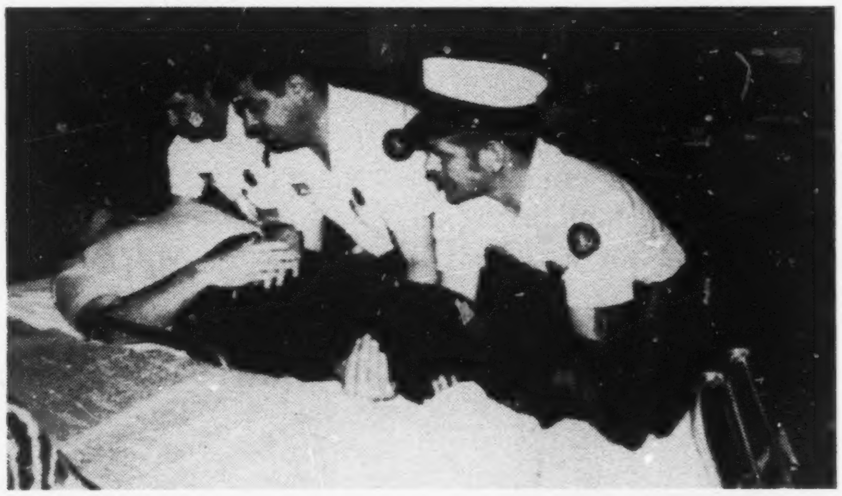
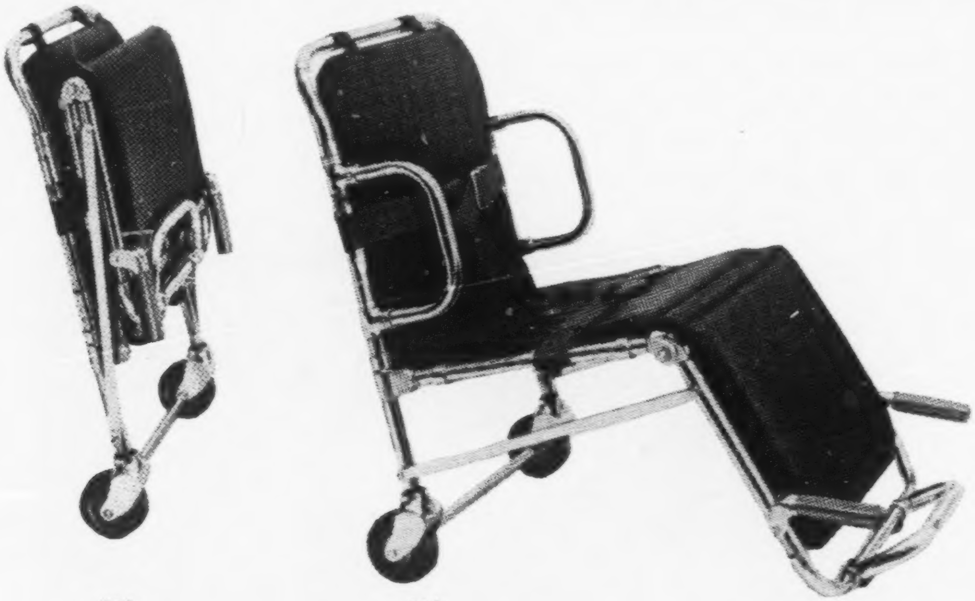


FIGURE 9. The cot has been moved in next to the couch and directly under the victim. Gently lower the victim to the cot.

THE STAIR CHAIR

A stair chair, see Figure 10, can be used where conventional stretchers and cots cannot be maneuvered. It will permit comfortable movement of a victim down a stairway, narrow hallway, and other close quarters.

Figures 11 through 14 show the stair chair in use to move a victim from an attic, down a narrow folding stairway, out the front door, down the porch steps to the ambulance.



(1) (2)

Courtesy: Ferno-Washington, Inc.

FIGURE 10. The stair chair

(1) Folded for compact storage.

(2) Opened position ready for use.

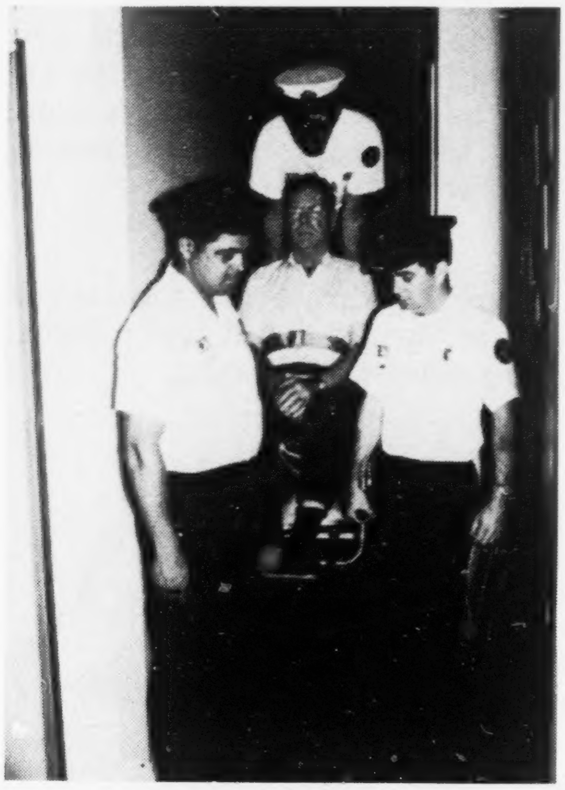


FIGURE 11. The victim is moved down a narrow, folding, attic stairway.

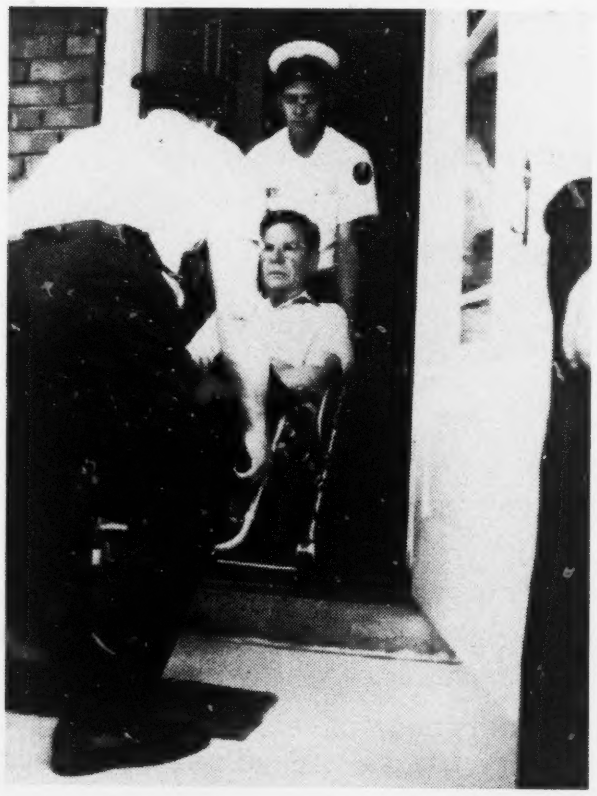


FIGURE 12. Through the door the chair is eased over the door sill.

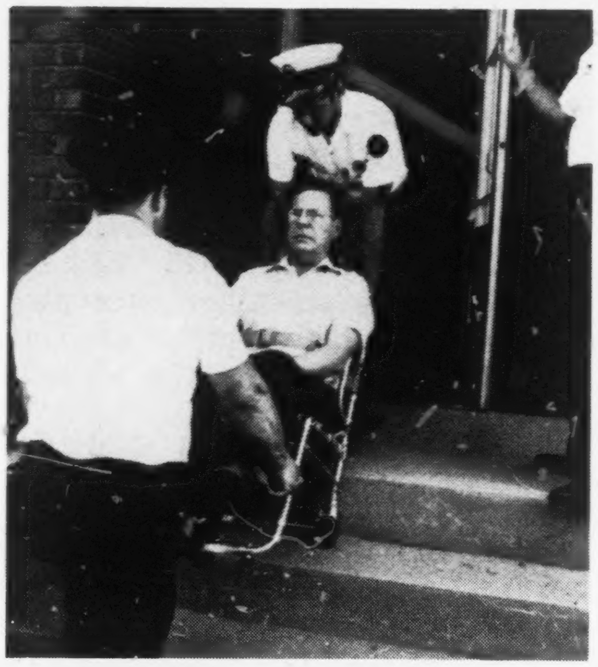


FIGURE 13. The chair is "walked" down the porch steps, similar to walking a refrigerator on a dolly.

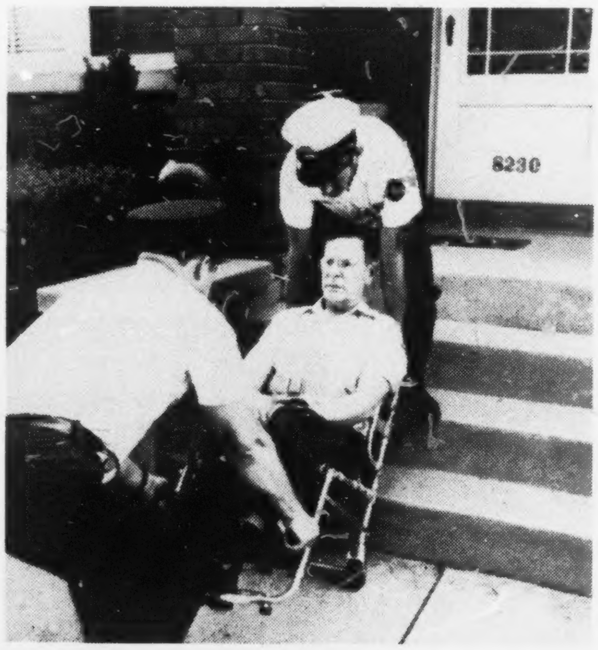
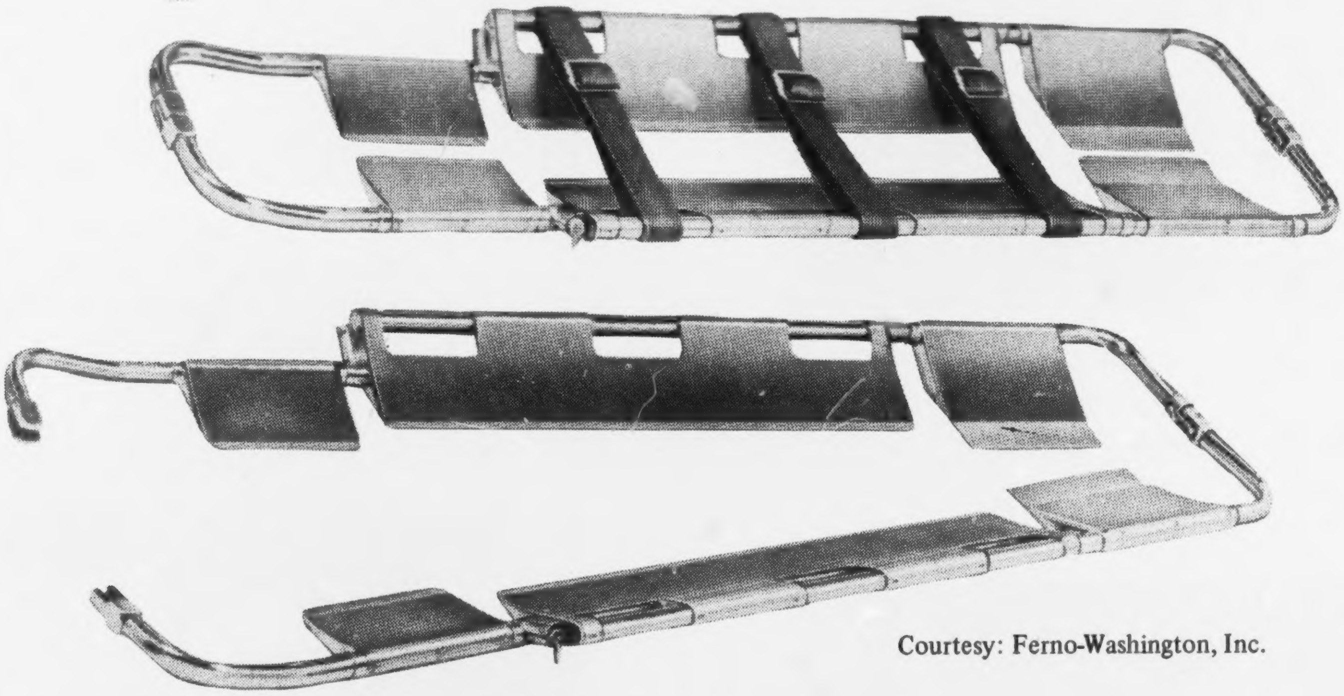


FIGURE 14. Reaching the side-walk the chair may be wheeled to the ambulance providing the pavement is smooth. The chair should be carried over rough or broken pavement for obvious reasons.

THE "SCOOP" STRETCHER

The scoop stretcher permits the picking up of a victim where, and in the position he is found, providing the area around the victim is clear and free of obstructions. See Figure 15. Either or both ends of the stretcher uncouple to provide ease of placement but care must be taken when securing the stretcher that parts of the victim's body are not "pinched." To avoid pinching the victim it may be necessary to lift or roll him slightly to permit total placement of the sides of the scoop.

Figures 16 through 20 show the scoop stretcher in use to lift and move a boy who was struck by an auto.



Courtesy: Ferno-Washington, Inc.

FIGURE 15. The scoop stretcher.

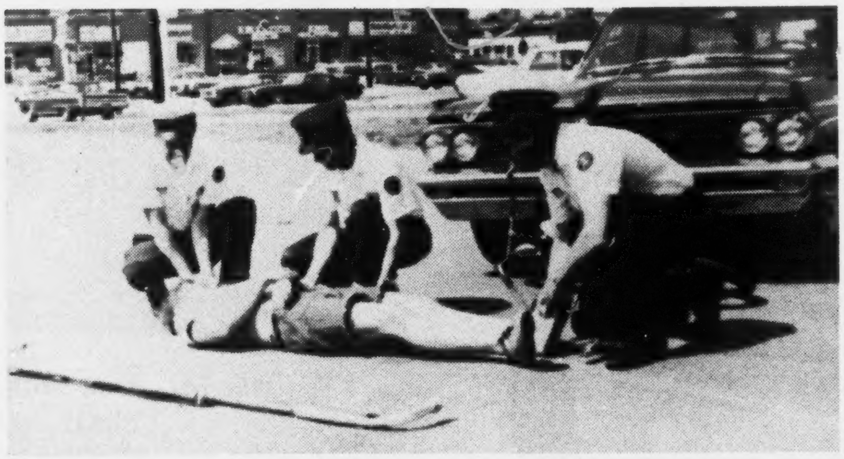


FIGURE 16. The squad has provided all necessary emergency care. A back injury was suspected, and the open area around the victim permitted use of the scoop stretcher.

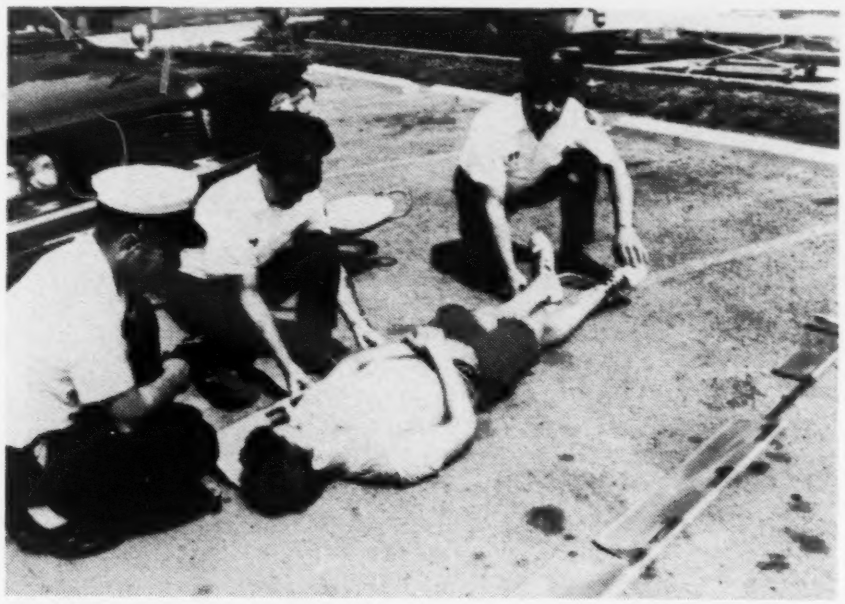


FIGURE 17. One side of the scoop is aligned and adjusted to proper length. The second side will be put in place, adjusted to match the first side, and connected at both ends.

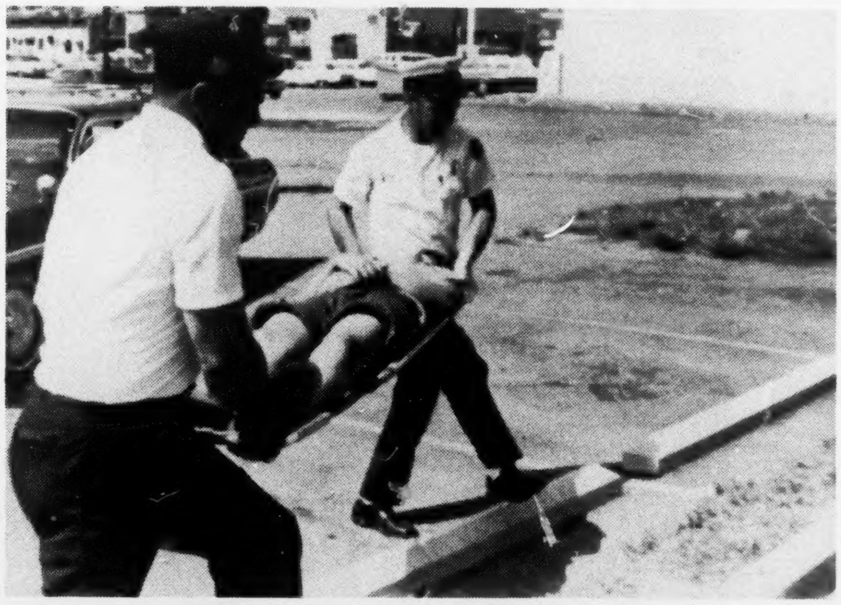


FIGURE 18. The boy is lifted and is being carried to the ambulance cot. Note the squadman stepping over the obstacle, first one squadman clears the obstacle and then the other steps over.

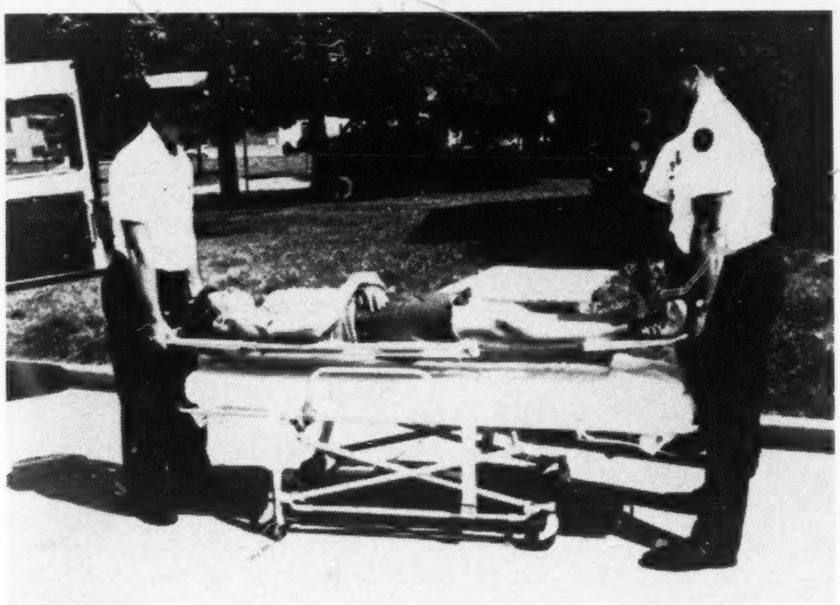


FIGURE 19. The ambulance cot is raised to a position to permit the squadmen to place the scoop stretcher on the cot without bending.

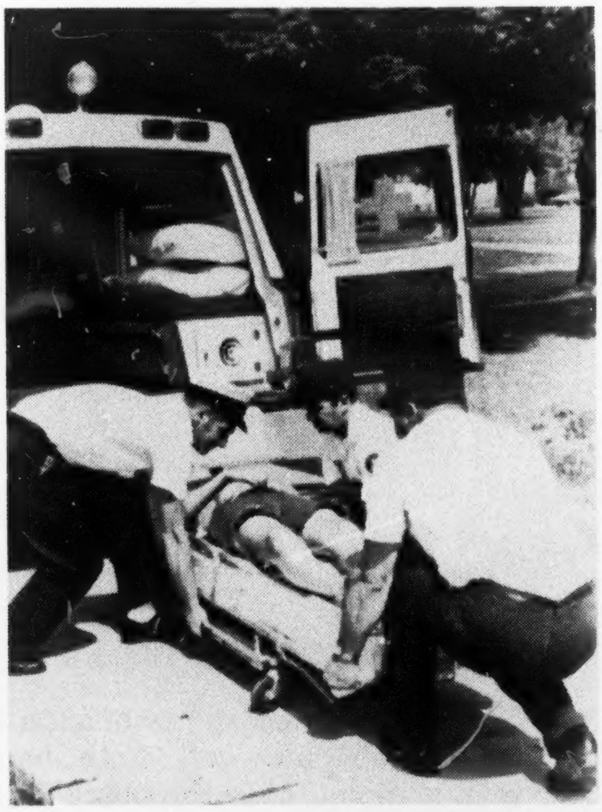


FIGURE 20. The cot is lowered and loaded into the ambulance. The victim is transported on the scoop stretcher in the position found.

CARRIES AND DRAGS

INTRODUCTION

An important aspect of emergency care is the successful removal of victims in situations where a stretcher or backboard cannot be used. Squadmen must be able to carry and drag victims quickly to safety in a variety of emergency situations, with minimum risk to the victims and to themselves. They must be prepared to rescue people who are injured or unconscious when the threat of an impending danger exists.

Persons who have been subjected to intense heat, heavy smoke, gases, or falling materials may become injured or unconscious. Squadmen should know the methods for carrying and dragging people to safety in such emergencies. Some common methods are described here.

Chair Carry - This is a good method. It is even better than a stretcher in places where sharp turns must be made or where steep stairways are encountered. The chair should be tested before use, to make sure it is solid and will support the victim. After the victim is placed in the chair, the man in the rear tilts the chair back to enable the man in front to get into his position. Carry as shown in Figure 21.

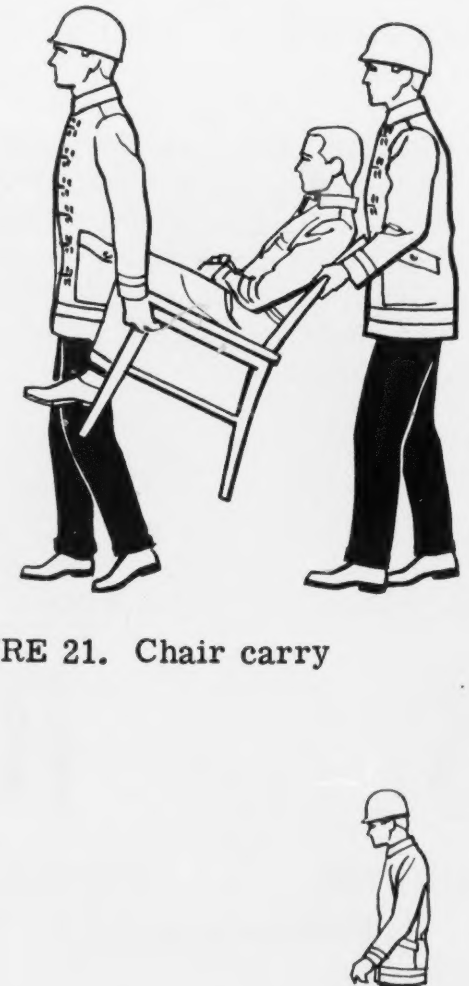


FIGURE 21. Chair carry

Fireman's Carry - To get the victim on the shoulder for this carry, balance and coordination of movement are very important. With this method, a squadman can raise any victim that he is able to carry. He places the victim on his back, knees up, and feet against buttocks, as shown in Figure 22A.

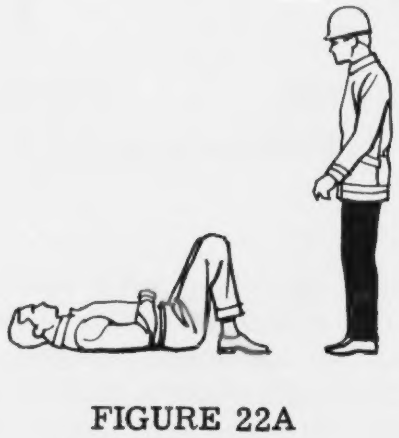


FIGURE 22A

He then grasps the victim's wrists with his palms down. See Figure 22B.

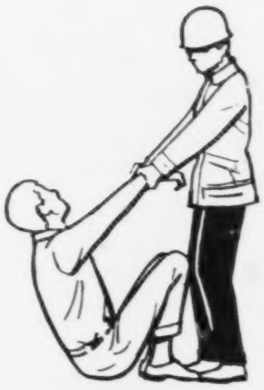


FIGURE 22B

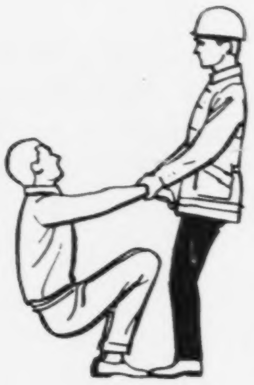


FIGURE 22C

The rescuer places his feet and legs against the victim's feet and legs, as shown in Figure 22C. Then, by leaning back and pulling the victim forward and up at the same time, he enables the victim to fall across his shoulder. See Figures 22D and 22E.

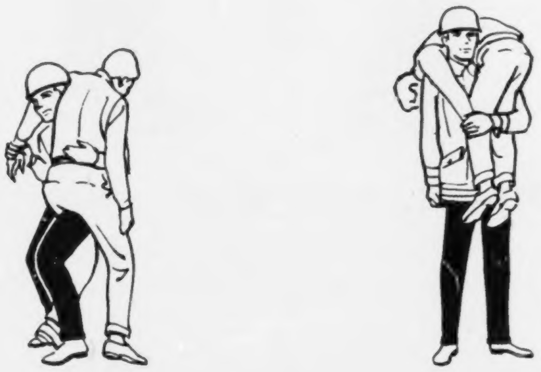


FIGURE 22D FIGURE 22E

Fireman's carry.

Carrying in Arms - To carry a patient in the arms, lift him, if he is unconscious, to an erect position as described in the fireman's carry. Support the patient with one arm about the body. Kneel on one knee and allow him to rest on your other knee. Pass your other arm under his thighs. Roll the patient into the hollow of the elbows and rise. See Figure 23.

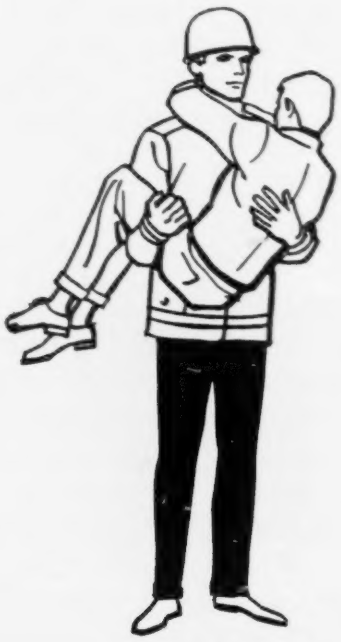


FIGURE 23. Carrying in arms.

Carrying Astride Back - Carrying astride the back is a comfortable one-man method of transportation, but is limited to carrying a conscious victim who can at least partially stand alone. The rescuer assists the victim to a standing position. Standing in front of the victim, he turns his back to him, taking the victim's arms over his shoulders and crossing them. He then bends forward until the victim rests on his back. He grasps each thigh, and with a humping motion, raises him well upon his back. Passing the forearms under the victim's legs, the rescuer then takes a wrist in either hand and the victim is loaded. This carry is so secure that the victim may become unconscious and yet be carried safely and easily. See Figure 24.

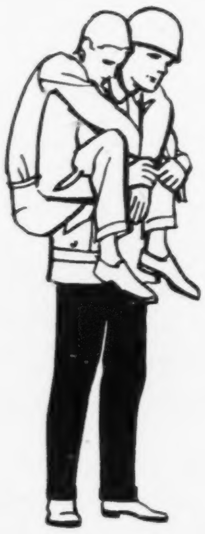


FIGURE 24. Carrying astride back

Pack Strap Carry - The pack strap method is a one-man carry that has two applications, one for a conscious and one for an unconscious victim. For a conscious victim, the loading is done exactly as described in the first part of the "astride back" method. See Figure 25A. When the victim is on the rescuer's back, the rescuer grasps his crossed arms at the wrists, bends forward, humping the victim well up on his back and proceeds in the manner shown in the illustration. Note that the rescuer has one hand free.

If the victim is unconscious, the loading is more difficult, likewise the carry. To make the carry, an improvised "pack strap" is used. The carry gets its name from the pack strap used. The pack strap consists of a loop of some type of material. A rope hose tool is excellent for this purpose, but a bed sheet or any other similar material may be used. The rescuer turns the victim on his back and passes the loop through, under his shoulders at the arm pits. He then places his body on that of the victim with his face up, slipping each arm through an end of the loop. The rescuer then rolls himself and the victim over, gets to his knees, then to his feet and from this squatting position rises to an erect position. See Figure 25B. Since both hands are free, the rescuer may proceed down a ladder or through difficult passages. Although the dangling legs of the victim are awkward, he cannot slip from the load. Also, the rescuer can shift the load from his back to leg muscles by bending forward.

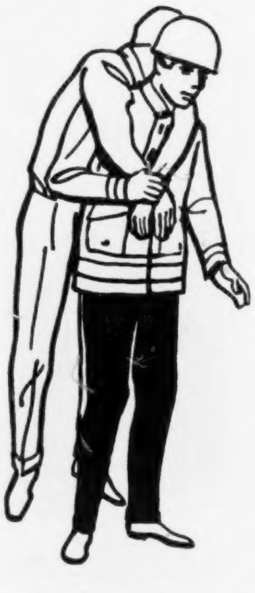


FIGURE 25A

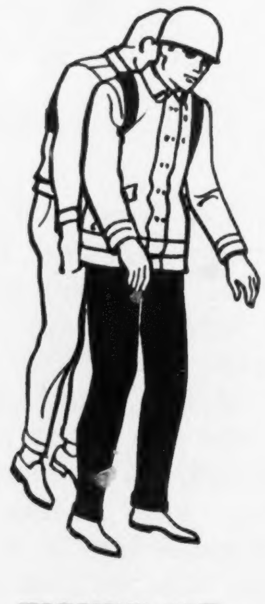


FIGURE 25B

Pack strap carry (conscious and unconscious)

Front Piggy Back - This one-man carry is excellent for carrying a conscious victim. To get the victim in position, face him and place hands under his arm pits. Lift as he jumps up putting his legs around your midriff, above the hips. The victim wraps his arms around the rescuer's neck. The rescuer has both hands free to climb or descend a ladder, open a door, etc. If trouble develops while descending a ladder, the rescuer can pin the victim against the ladder until help arrives or the trouble is eliminated. See Figure 26.

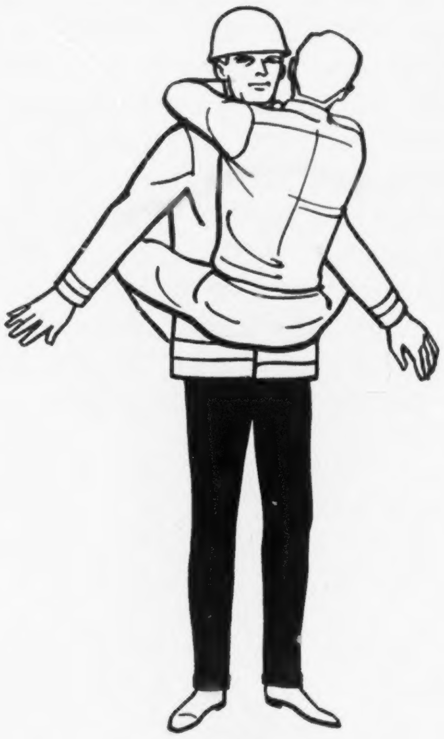


FIGURE 26. Front piggy back

Two-Man Seat Carry - The seat carry seen in Figures 27A and 27B is a two-man means of carrying an injured or unconscious person. It consists of making a seat rest of one pair of arms and a back rest of the other pair. Figure 27A shows how the arms are arranged when completed. The rescuers kneel, one on either side of the victim near the hips, and raise him to a sitting position steadying him with the arm nearest his head around his neck.

Each rescuer then slips his other arm under the victim's thighs, clasping the wrist of the other rescuer. Both arise slowly, in unison, lifting the victim from the ground. When erect, they adjust their upper arms to form a comfortable back rest and to make the victim secure. See Figure 27B. If conscious, the victim assists the rescuers by grasping them around the necks with either or both arms.

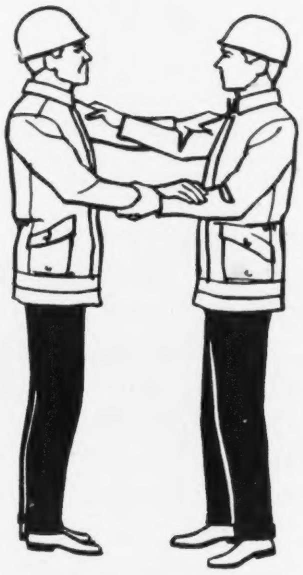


FIGURE 27A

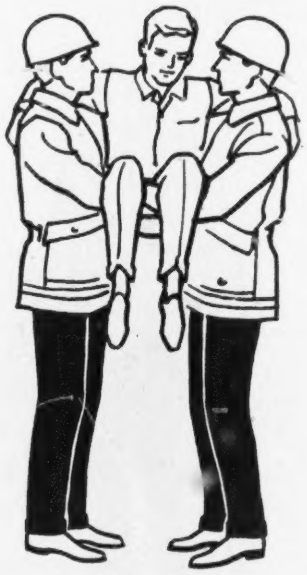


FIGURE 27B

Two-man seat carry

Carrying By the Extremities - This is a good method, but should not be used if the victim has any fractures. The victim is laid straight on his back, feet apart. One rescuer takes his place between the victim's legs and the other at his head, facing each other. The rescuer at the victim's feet turns his hands palms down, grasps the victim's wrists, and pulls him to a sitting position. The man at the victim's head assists in raising him to a sitting position by lifting his shoulders. See Figure 28A.

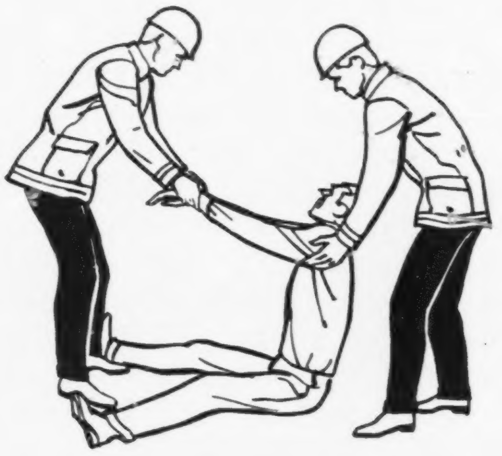


FIGURE 28A

The rescuer at the head position kneels on one knee and supports the victim's back with the opposite knee and leg. Then he extends his hands, palms down, under the victim's armpits from back to front. The rescuer at the victim's feet, who has been holding the victim's wrists, places them in the extended hands of the other rescuer, who grasps them firmly. See Figure 28B.

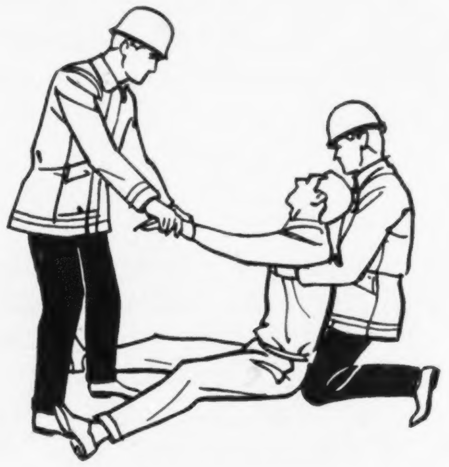


FIGURE 28B

The rescuer at the victim's feet turns his back to the victim, kneels on one knee, and passes his hands under the victim's knees from the outside. The rescuer at the head position gets into a baseball catcher's position, keeping his back vertical. At the order "Rise", by either of the two rescuers, both rise by straightening their legs, and move forward. See Figure 28C.

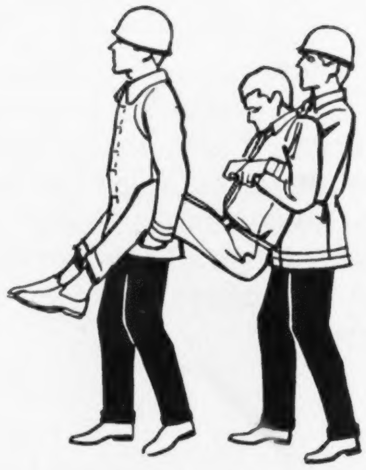


FIGURE 28C

Carrying by the extremities

Three-Man Carry - The three-man carry is used for badly injured persons. See Figures 29A, 29B, and 29C. The carry is accomplished as follows: Three men line up on one side of the victim and the leader gives the command, "Prepare to lift." Each man kneels on the knee nearest the victim's feet, so that one man is at his shoulders, one at his hips, and one at his knees. Without further orders, they pass their hands and forearms under the victim, as shown in Figure 29A. The one at the head places his hands under the victim's neck and back, the second under the pelvis and hips, and the third under the knees and ankles. At the command, "Lift," they raise the victim and place him on their knees, but without releasing their hands. See Figure 29B.

At the command, "Prepare to rise," they slowly turn the victim on his side, toward them, until the victim rests in the bend of their elbows. At the command, "Rise," all rise to a standing position, holding the victim against their chests, as in Figure 29C. To move directly forward, the command, "March," is given and all three step off on the left foot and continue until the command, "Halt" is given. To move sideways, the command, "Side step left", (or "Side step right",) is given. The rescuers step off with the foot according to the command, bringing the other foot up to it in even, short steps. The victim is then lowered by reversing the operations but always at the command of the leader.

In actual practice, however, it should not be necessary to give detailed commands. The men should be so well trained that they can move and act in unison with a minimum of commands.

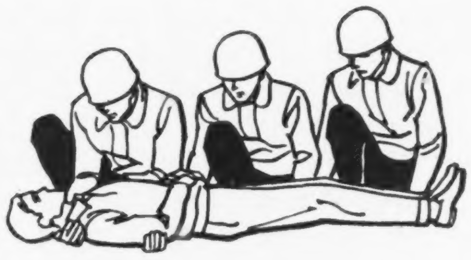


FIGURE 29A

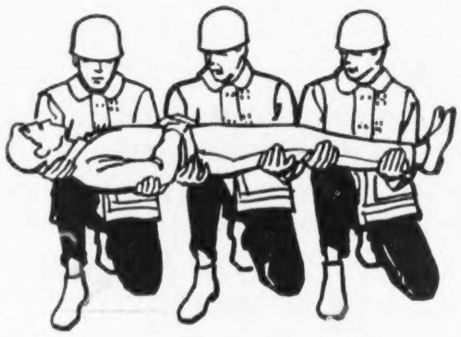


FIGURE 29B

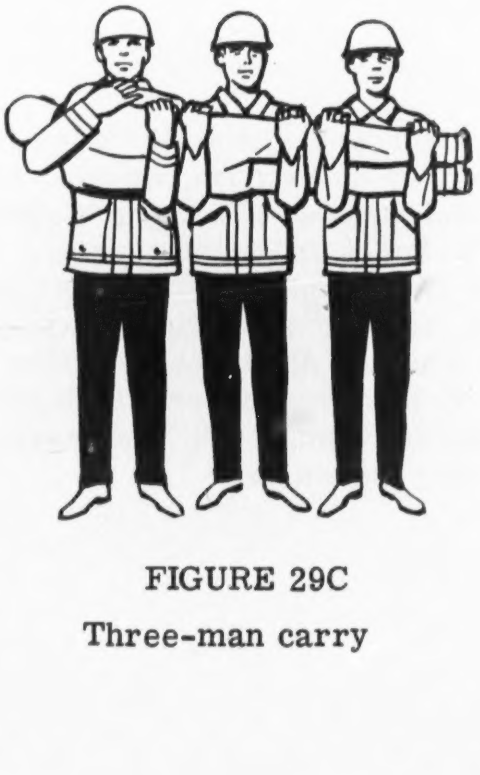


FIGURE 29C

Three-man carry

Clothes Drag - When a squadsman must rescue a victim who is too heavy to be carried, other means must be used to get the victim to safety. The clothes drag, Figure 30, is one method that can be used. The rescuer's hand should grasp the victim's collar with the victim's head resting on the rescuer's arm for protection.

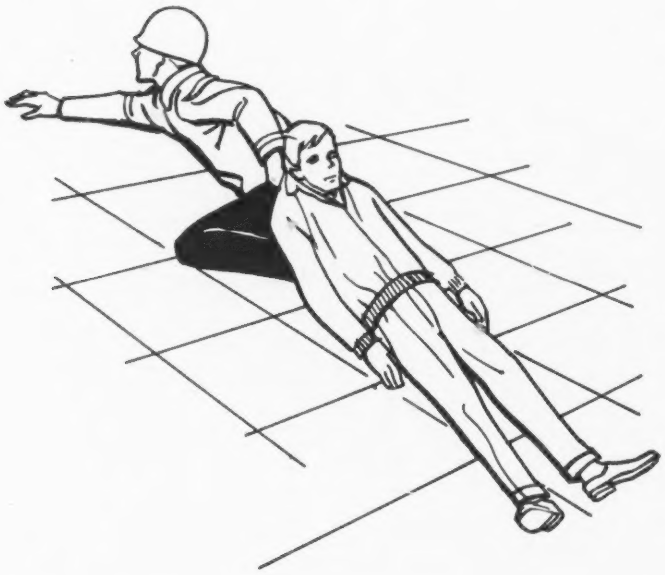


FIGURE 30. Clothes drag

Fireman's Drag - In making a fireman's drag, the victim's wrists are tied together with a square knot as shown in Figure 31.

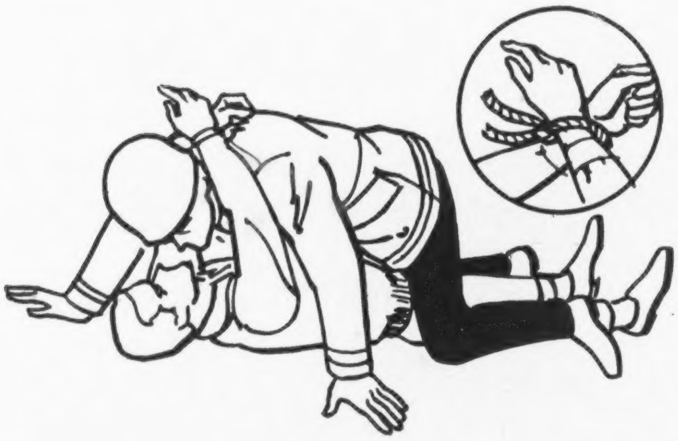


FIGURE 31. Fireman's drag

The rescuer then straddles the victim and passes his head between the arms, raises the victim's head and shoulders just off the floor, and then, by crawling, drags the victim out.

For descending a stairway when using the fireman's drag, the rescuer's position is reversed and he descends the stairs backwards. This prevents the victim's head from hitting the steps.

The Blanket Drag - The blanket drag can be used in place of the clothes drag when the victim is nude or the clothing being worn is too flimsy to be used to drag the victim. Place a blanket on the floor and roll victim onto the blanket. The victim can then be removed to safety as shown in Figure 32.

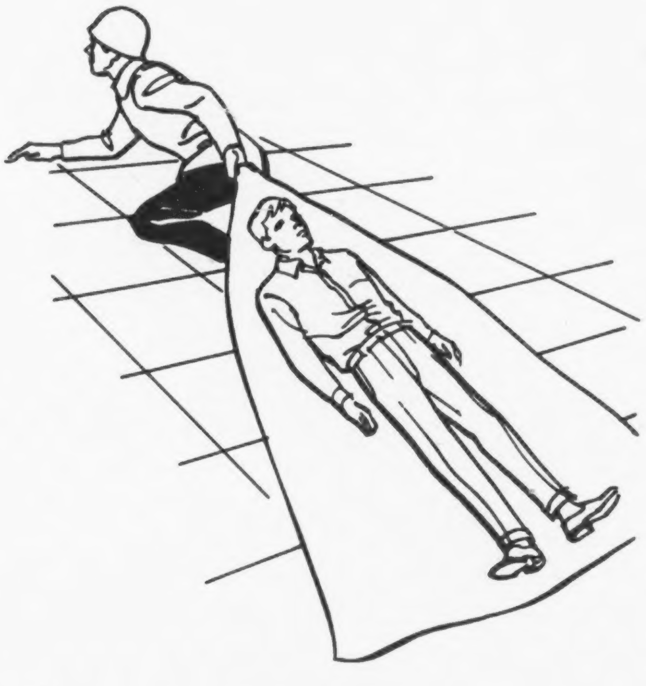


FIGURE 32. Blanket drag

CHAPTER XXVI

EXTRICATION FROM AUTOMOBILES

INTRODUCTION

The proper use of the recommended minimal light rescue equipment for the emergency ambulance will, in the majority of instances, provide the means to open the wreckage and safely remove the victims. If the wreckage is of such a great magnitude that heavier rescue equipment must be summoned, then it is anticipated that the emergency personnel can utilize the minimal equipment to gain access to the victim and provide the necessary life-support measures until the heavy rescue vehicle and equipment arrive to perform their mission.

THE HIGHWAY ACCIDENT

Enroute to the accident scene, emergency personnel must anticipate the possible hazards that may be posed by the location and type of emergency. Upon arrival at the scene, every effort must be made to park the ambulance vehicle in a position that will provide proper use but will prevent an additional accident or hazard.

A rapid size-up of the accident scene must be made to identify existing situations that may endanger the victim and the emergency personnel, such as spilled gasoline or chemicals, escaping gases, downed power lines, and fire. If such hazards exist, the proper agency must be notified and assurance given that immediate assistance will be dispatched. In the absence of a law enforcement officer, and if available manpower and the victim's condition permits, proper warning devices should be placed to alert oncoming traffic.

When the police or other authorities are at the scene, the ambulance personnel will avoid assuming their functions. However, the ambulance personnel should not permit the police actions to compromise proper emergency care of the victims.

Proper pre-planning as discussed in Chapter VII will have directed the law enforcement officer at the scene to exert every effort to permit the ambulance access to the scene, afford all possible protection from further danger, and to assure an open lane for the departure of the ambulance.

ENTRY TO THE VICTIM--RELEASE FROM ENTRAPMENT

The accident victim must receive immediate emergency care before being moved. The only exception would be an impending danger that may threaten, not only the victim, but also the emergency personnel. If the victim must be moved because of a threat of fire or explosion, he must be dragged in line with the long axis of his body.

In many instances before emergency care can be given, access must be gained to the victim. In the majority of accidents this presents no great problem. Doors that are jammed can be pried open and sprung as shown in Figures 1, 2 and 4. If the victim is pinned in the wreckage, administer all possible life-support care (maintain an open airway, control bleeding and treat for shock) during extrication, and offer continued reassurance.

A victim pinned by the dashboard can be released by raising the dash with a hydraulic rescue kit (see Figure 3). This hydraulic tool can be adapted to push, pull, lift, and compress. Figures 5 through 9 point out a few of its many adaptations.

Steering wheels, the cause of many internal injuries, always seem to be "in the way" during extrication. If the steering wheel is hindering rescue, it can be raised as shown in Figure 7, or it can be cut away with an electric power saw. See Figure 10.

If the wreckage is so great as to prevent access through the doors, entry can be gained through windows. Breaking of glass near the victim may cause additional injury and fear. Figures 11, 12, and 13 show one possible method to remove either a windshield or back window to gain safe entry to the victim.

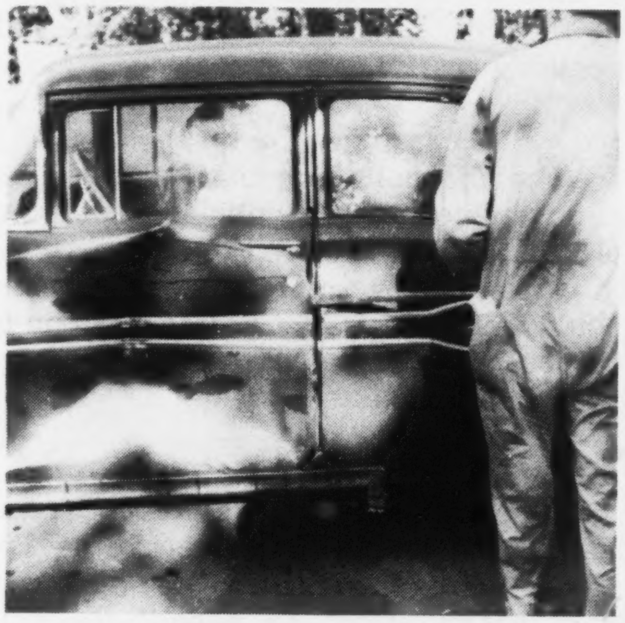


FIGURE 1. A pry bar being used to force open a jammed door. This tool in many instances is all that is necessary to open the door. Once partially open the door can be sprung to provide access to the victim.

Figures 1, 2, 4, 5, 6, 7, 8, 9, courtesy of the Sharonville, Ohio, "Life Squad."

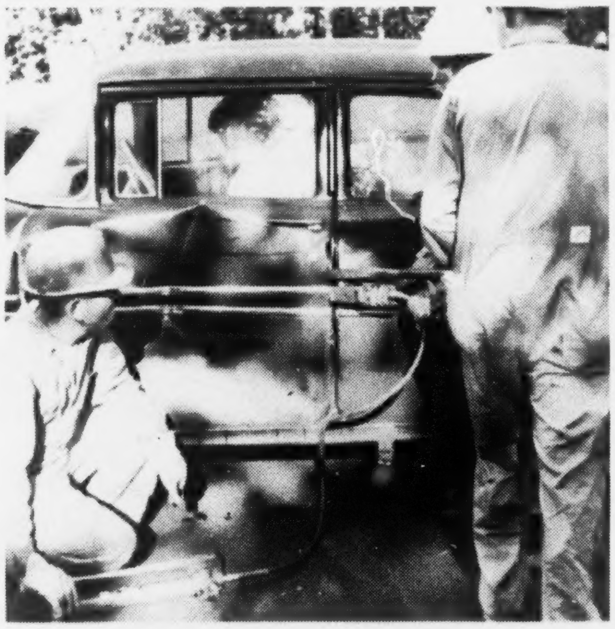
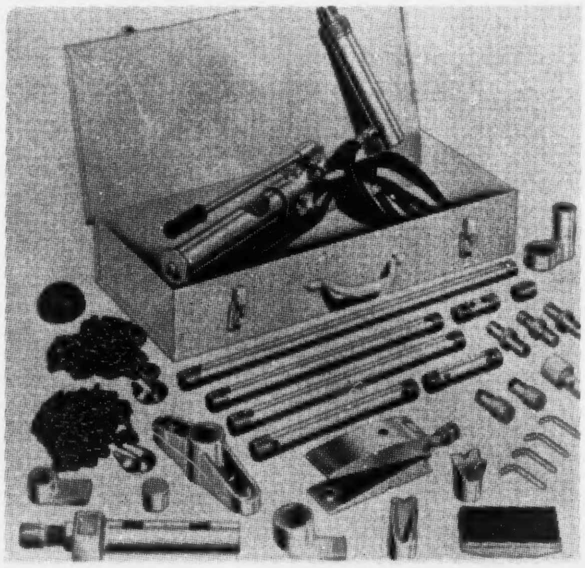


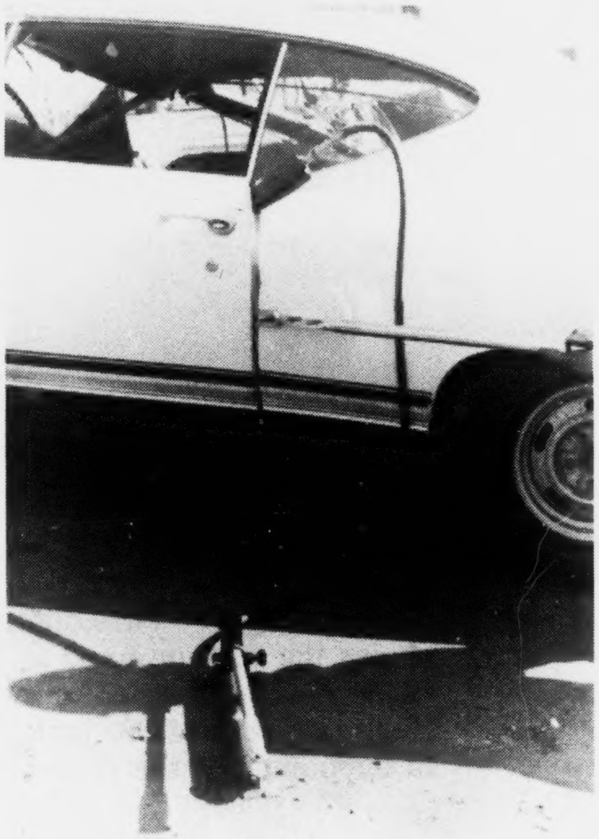
FIGURE 2. The pry bar being used to permit entry of the spreader unit of a hydraulic rescue kit.



Courtesy Blackhawk Mfg. Co.

FIGURE 3. The hydraulic rescue kit.

FIGURE 4. The "Hux Bar," a most versatile tool, being used as a pry bar to provide a sufficient opening for entry of the spreader unit.



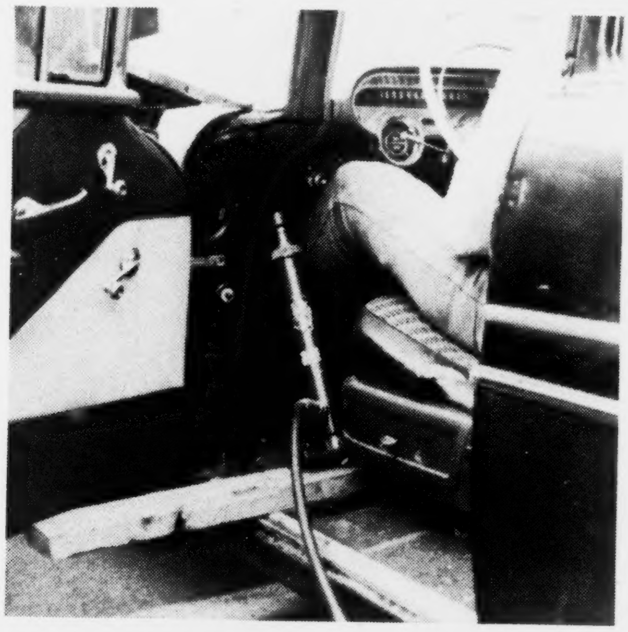


FIGURE 5. The "Jack" unit of the hydraulic rescue kit being used to raise the dashboard to free the victim. Notice the wood block support for the jack. This is necessary for most floor boards will not withstand the exerted force and the jack may push through the floor.

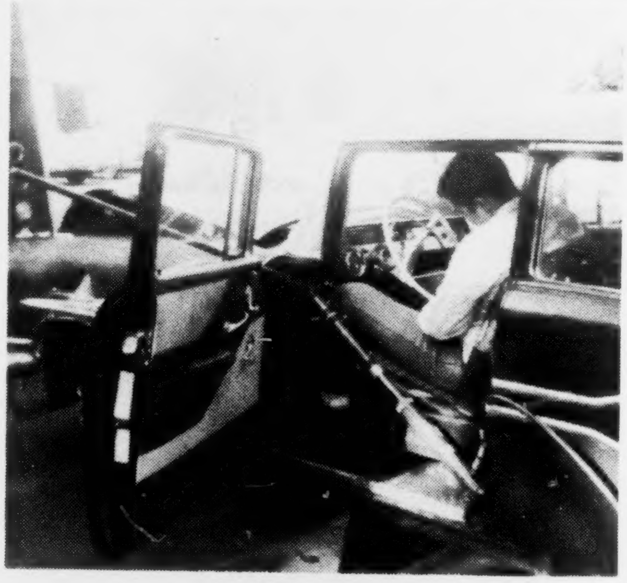


FIGURE 6. Another adaptation of the hydraulic rescue kit in position to raise the dashboard. Here the jack is positioned at the base of the center post for support.

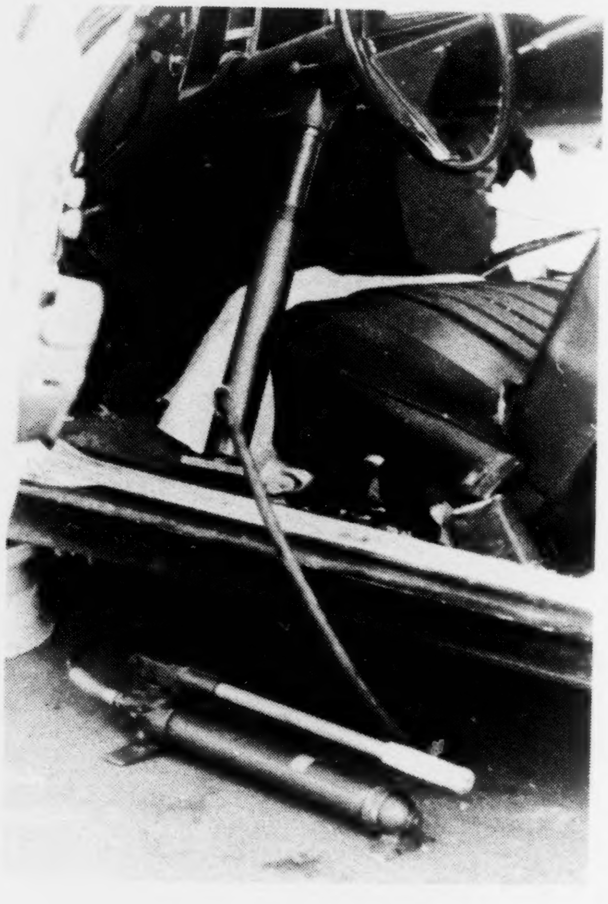


FIGURE 7. The victim having been safely removed through the right door. This photo shows the method used to raise the steering column. Here the base of the jack is supported at the frame.

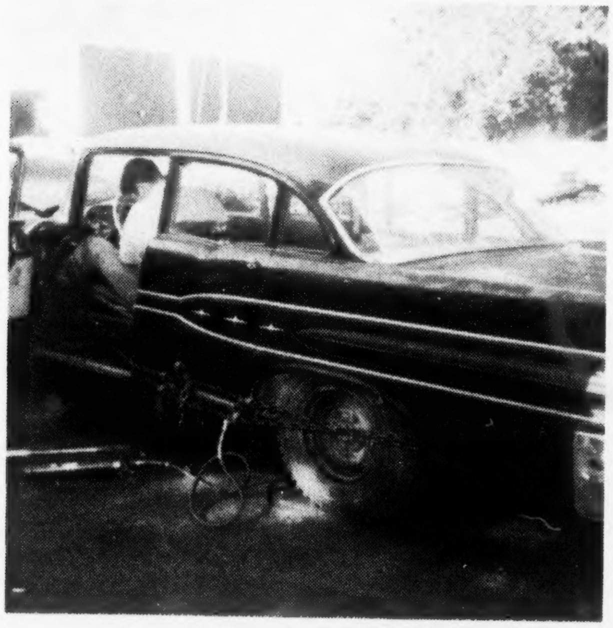


FIGURE 8. This photo shows the hydraulic power tool being used to "pull" the seat back to free the victim. One end of the chain is anchored to the frame, and the other end is wrapped around the seat undercarriage. During actual rescue operations, a squadman must be in the car to support and reassure the victim.

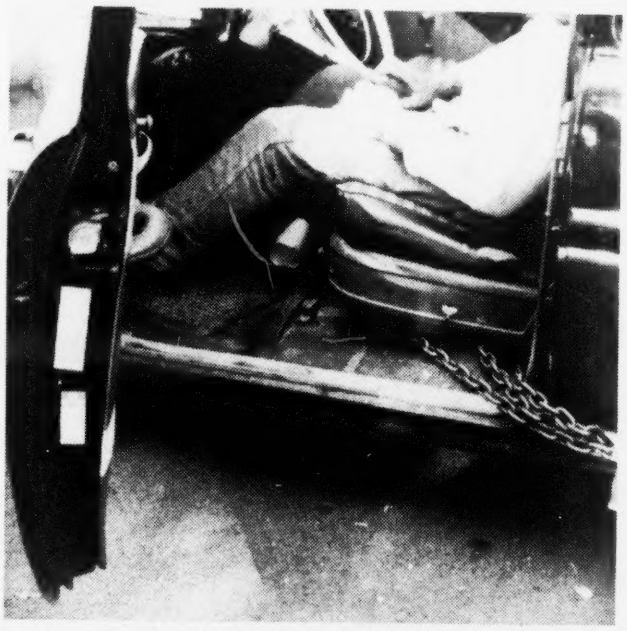
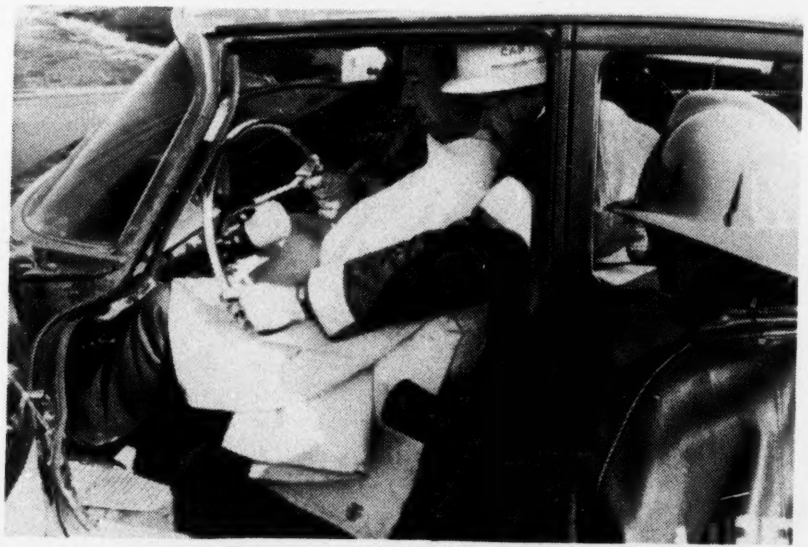


FIGURE 9. A closer view of the chain around the seat undercarriage.



Courtesy of Martins Ferry, Ohio, Emergency Squad.

FIGURE 10. Removal of the steering wheel with an electric power saw. The victim is protected with a fire-resistant blanket and is being reassured. The possibility of fire being remote, precautions are still taken and a proper extinguisher is being manned.

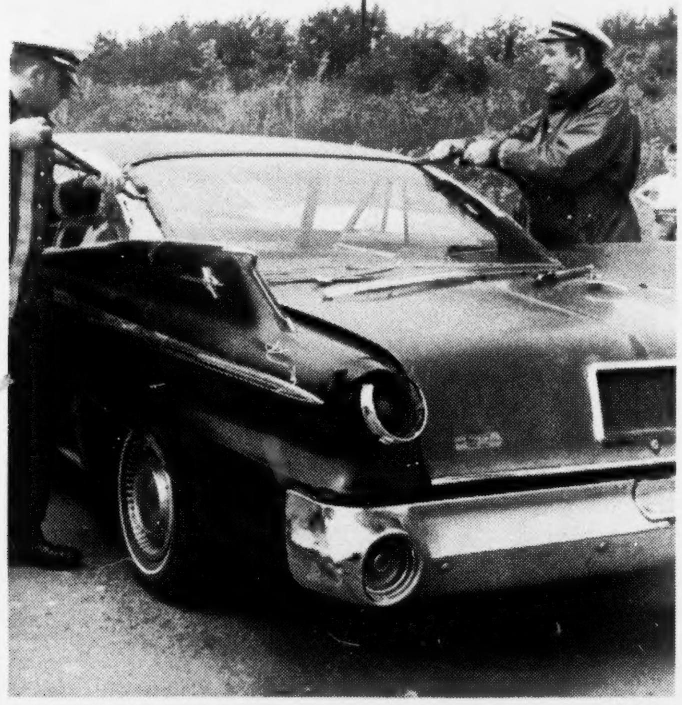


FIGURE 11. To gain entry to the victim while awaiting heavier equipment, the windshield, or as shown, the rear window can be removed. Using a small bar, remove the metal molding, this will expose the rubber seal.

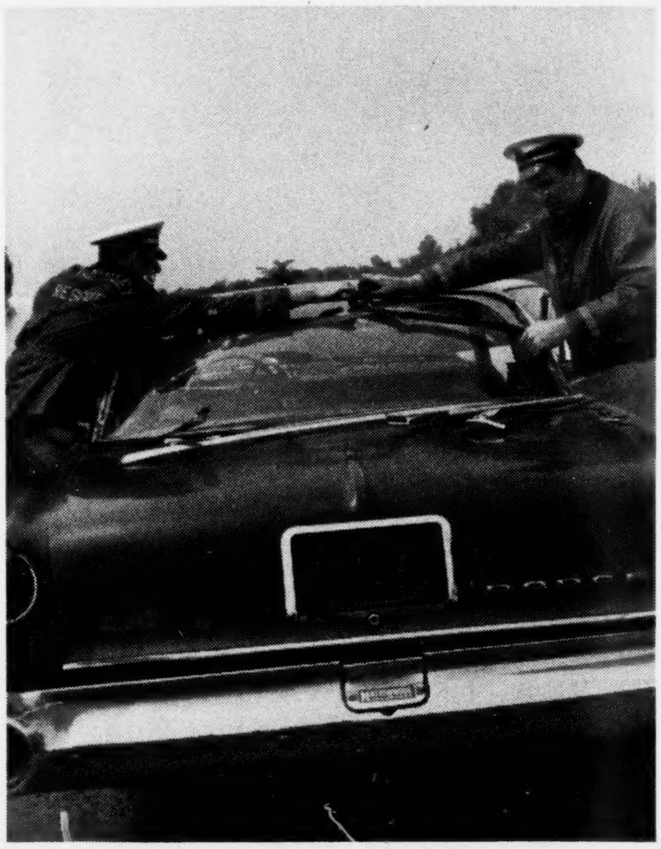


FIGURE 12. The rubber seal can be pried loose and pulled out as shown.

Figures 11, 12, 13, courtesy of the Harrison Township Fire Department, Fort McKinley Station, Dayton, Ohio.

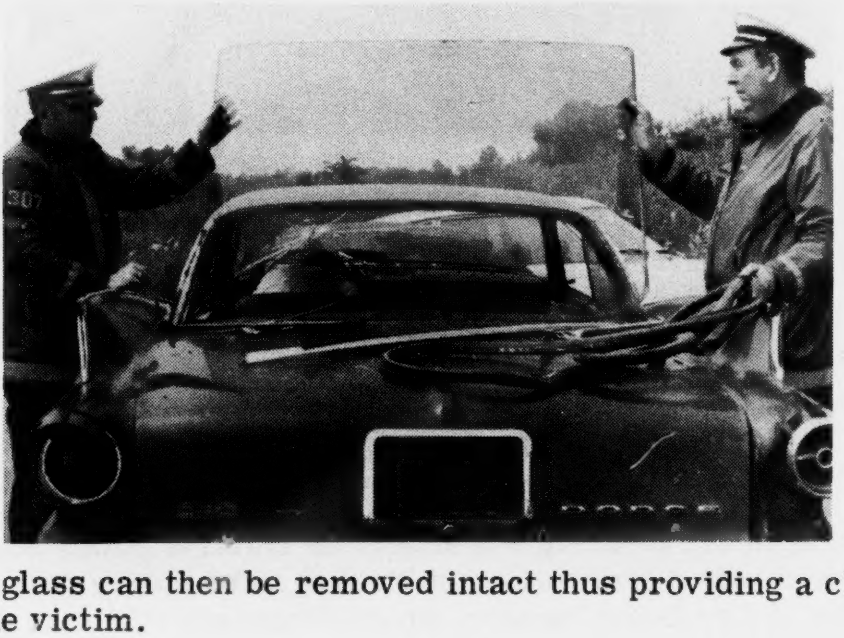


FIGURE 13. The glass can then be removed intact thus providing a clean, safe access to the victim.

REMOVAL OF VICTIMS FROM AN AUTOMOBILE

Victims of auto accidents are especially likely to have head, neck, and back injuries. Moving of these victims carelessly has resulted in needless deaths and permanent paralysis. All emergency medical personnel must learn the procedures for removing a victim: (1) from the driver's seat, (2) from under the dashboard, (3) from a position across the front seat, and (4) from the back floor or seat.

Some of the victim removal procedures require more than the usual number of responding personnel. Other persons, such as policemen, relatives, or bystanders, can be shown how to help. However, do not hesitate to call headquarters for additional help if it is needed to carry out an involved procedure.

REMOVAL FROM THE FRONT SEAT-SITTING POSITION OF A CONSCIOUS VICTIM WITH NO SUSPECTED HEAD, NECK, OR BACK INJURIES

To provide as much working room as possible, attempt to slide the front seat back gently while supporting the victim. See Figure 14.

If the victim is conscious, and does not have any suspected head, neck, or back injuries, but due to other injuries must be removed from the vehicle, the following procedure can be followed.

A squadman positions himself behind the victim, in the back seat. (See Figure 15.) He slides his hands under the victim's armpits, grasps the victim's wrists, and crosses the victim's arms.

As this is being done, one squadman stands ready with the backboard and another squadman stands at the opposite door.

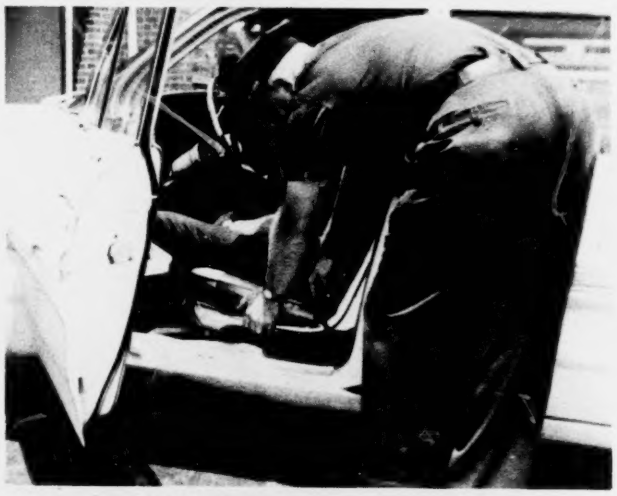


FIGURE 14. A car seat can be slid back.

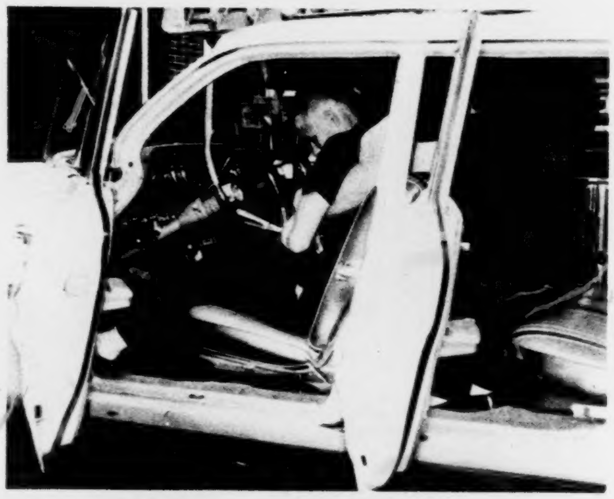


FIGURE 15. The victim is grasped by his arms.

The squadman in the car then arches his back against the car roof, and raises the victim just enough to slide the board under the victim. (See Figure 16.)

The victim is then pivoted on the board. Both his feet are kept together at all times. The squadman in the back seat then "gives" the victim to the squadman at the opposite door, who lowers him to a horizontal position. (See Figure 17.)

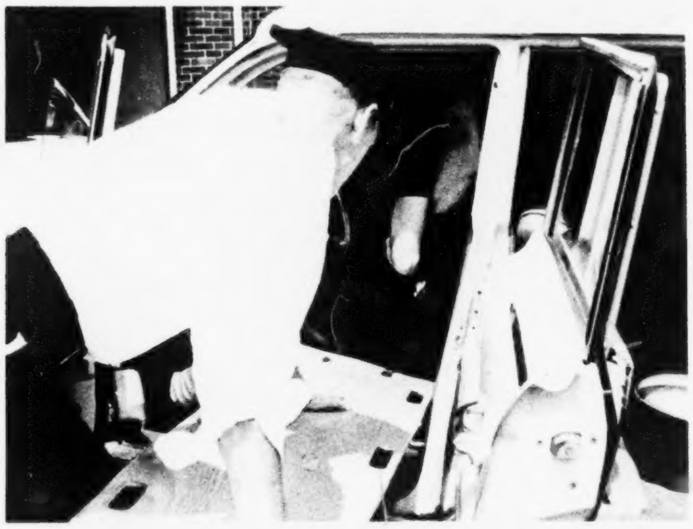


FIGURE 16. One squadman slides the board.

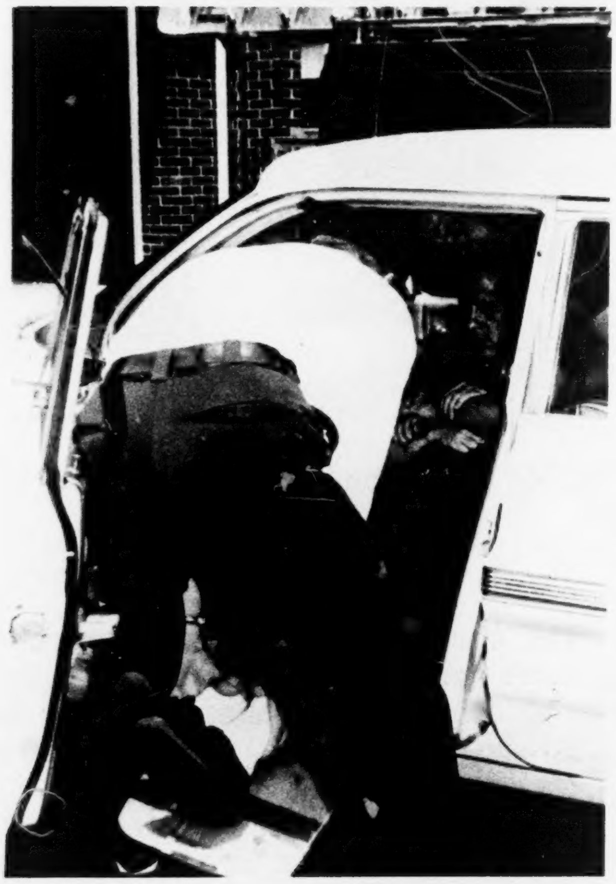


FIGURE 17. The victim is pivoted.

All three squadmen then come to the driver's side. Together they slide the victim out of the car. (See Figure 18.) He can then be transferred to the squad stretcher.

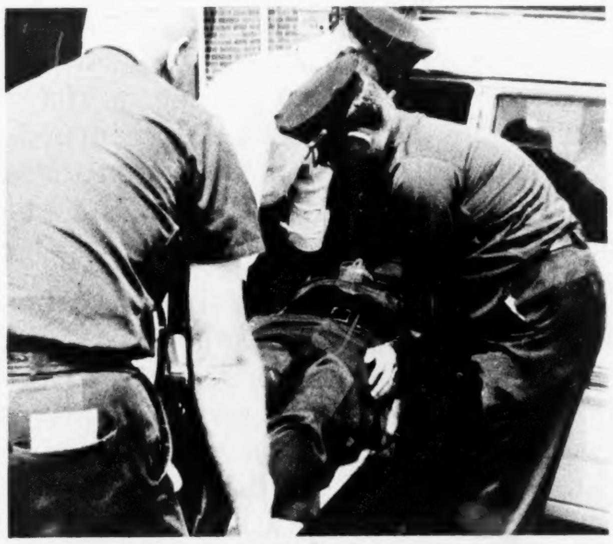


FIGURE 18. The victim is removed.

REMOVAL FROM THE FRONT SEAT-SITTING POSITION OF AN UNCONSCIOUS VICTIM AND/OR NECK AND BACK INJURIES

All unconscious victims of auto accidents must be suspected of having a neck or back injury and must be properly immobilized before removal attempts are made.

The half-backboard serves as an effective tool to immobilize sitting victims with suspected neck or back injuries, or for victims in awkward positions. Two straps, 9 feet long, are used to secure the victim to the board. Figures 19 through 28 and the accompanying captions point out the important steps of this procedure.

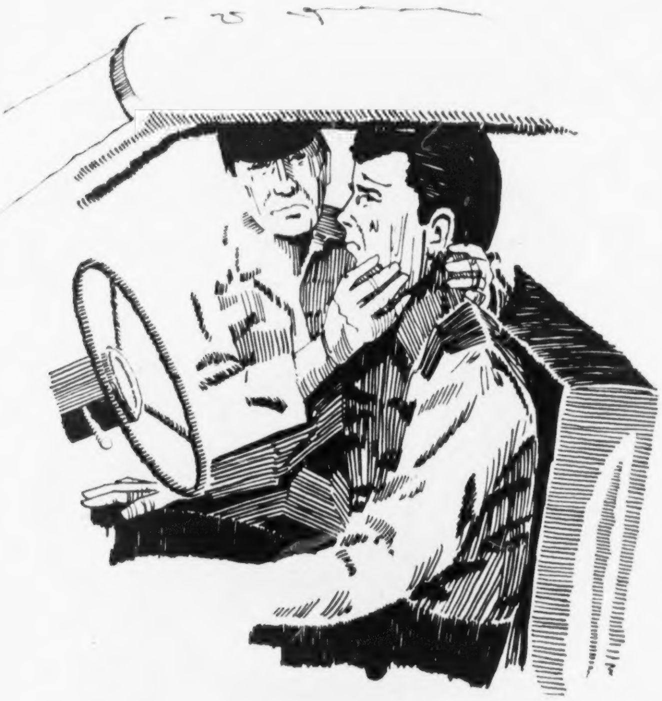


FIGURE 19. The victim's head is supported prior to, and during, immobilization.

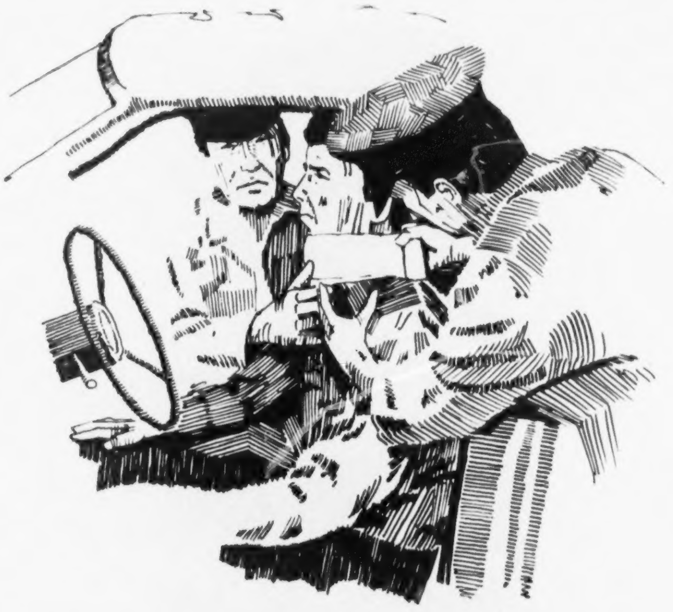
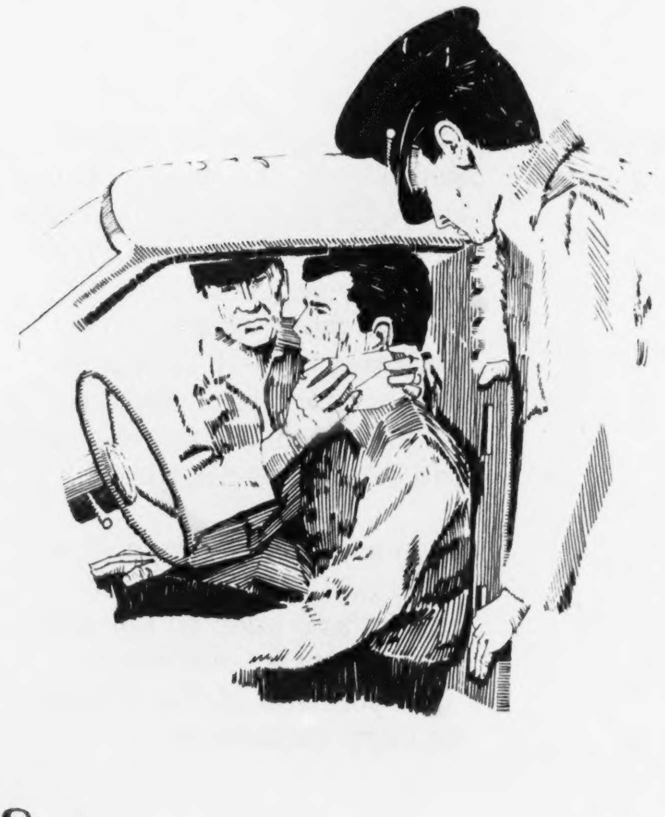


FIGURE 20. With continued support to the victim's head and neck, an improvised cervical collar is applied. A commercial cervical collar of the proper size can be used, but, as shown, two universal dressings folded longways are wrapped around the victim's neck and held in place with a soft roller bandage.

FIGURE 21. As shown, the short board is being positioned behind the victim while his head is being supported. Because of low doorways on many cars, it may be necessary to pass the head end of the board in first and then position the board properly behind the sitting victim.



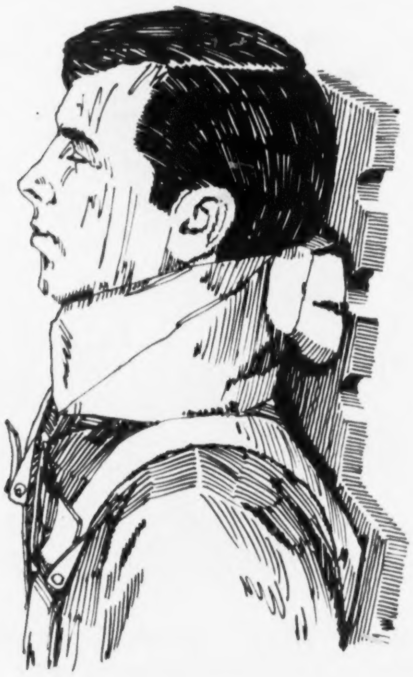


FIGURE 22. Before securing the victim to the board, a neck roll is placed to pad the existing hollow space behind the neck. This can also be made from folded universal dressings and rolled to the proper size.

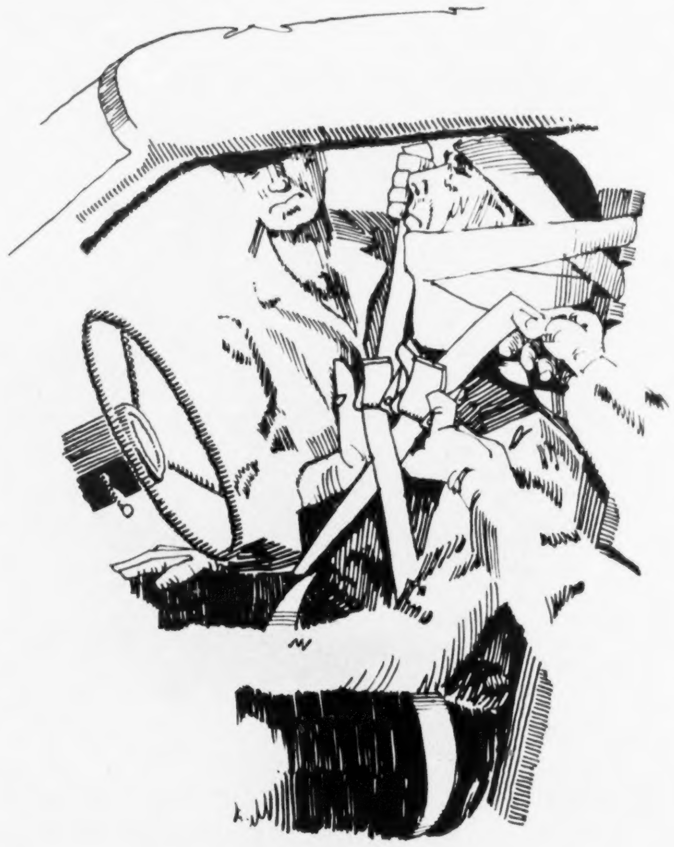


FIGURE 23

FIGURES 23 & 23A. The victim's head is now secured to the board. Commercial straps with velcro fasteners (hook-loop type) can be used, or the head can be secured as shown with two cravat bandages or a soft roller bandage. Attention must be given to the airway at all times.

Two nine foot straps of a material that will slide easily are used to secure the victim to the board. The position of the straps is very important.

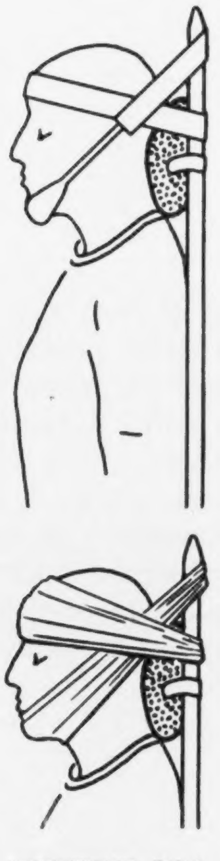


FIGURE 23A

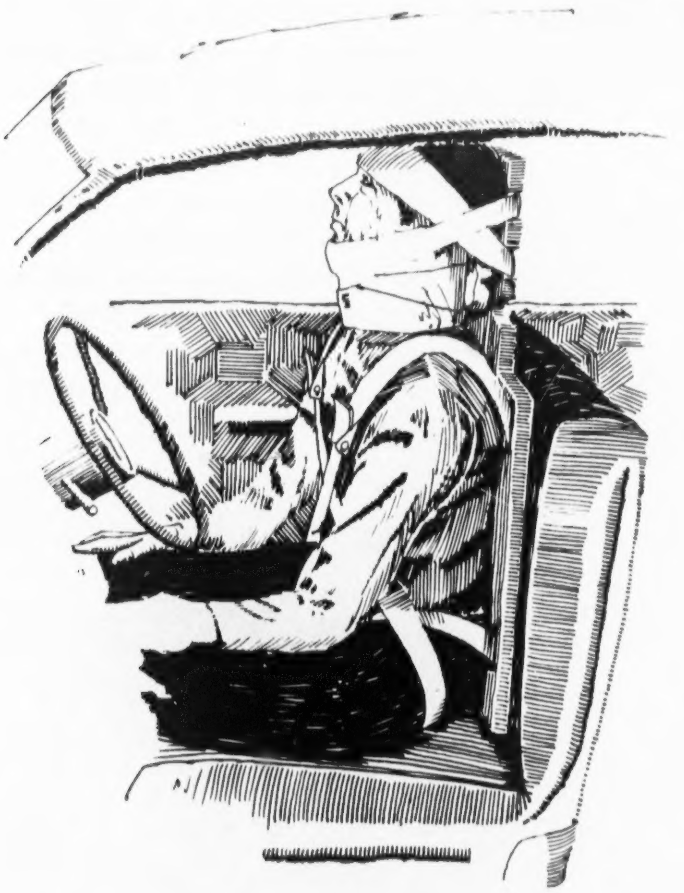


FIGURE 24

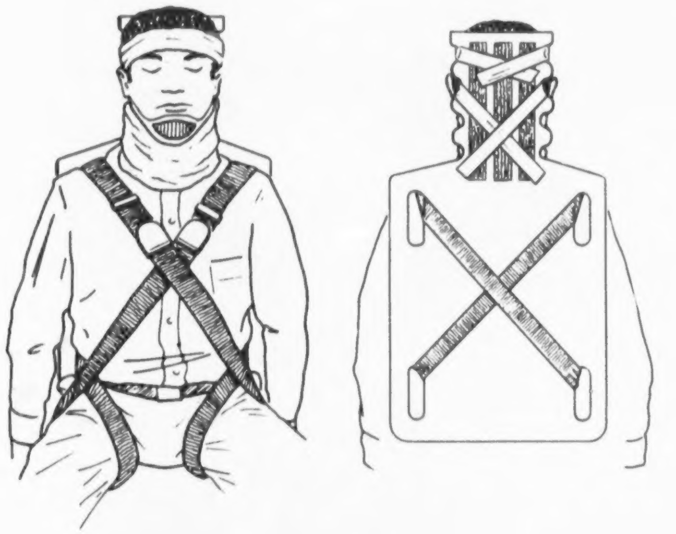


FIGURE 24A

FIGURES 24 & 24A. The victim is secured to the board. The straps go through the top hand hole, from front to back, cross behind the board to the opposite lower hand hole, coming from back to front, then going over the thigh at the groin, under and around the outside of the thigh, up across the chest to the buckle. The long straps must be positioned well up under the thighs and snug about the chest.

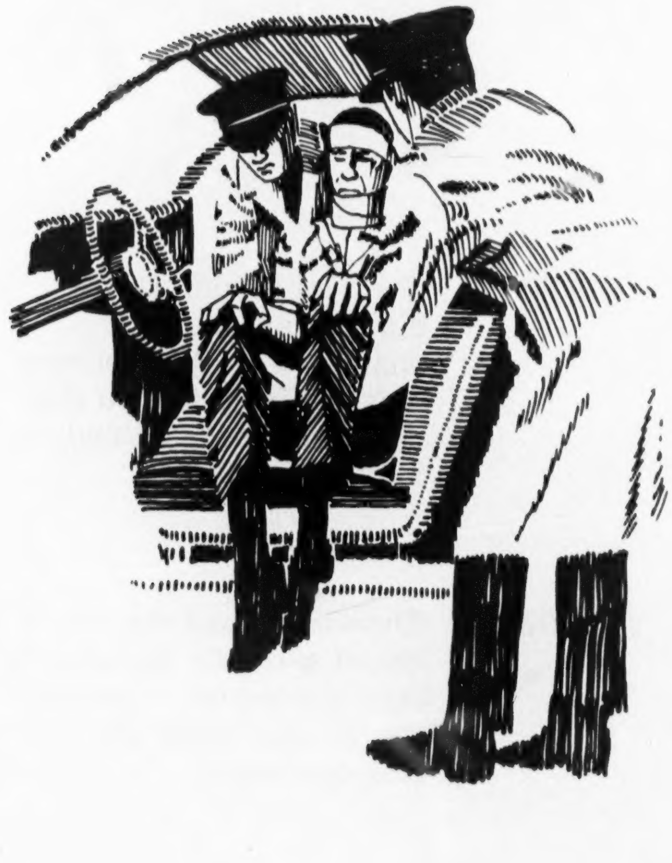
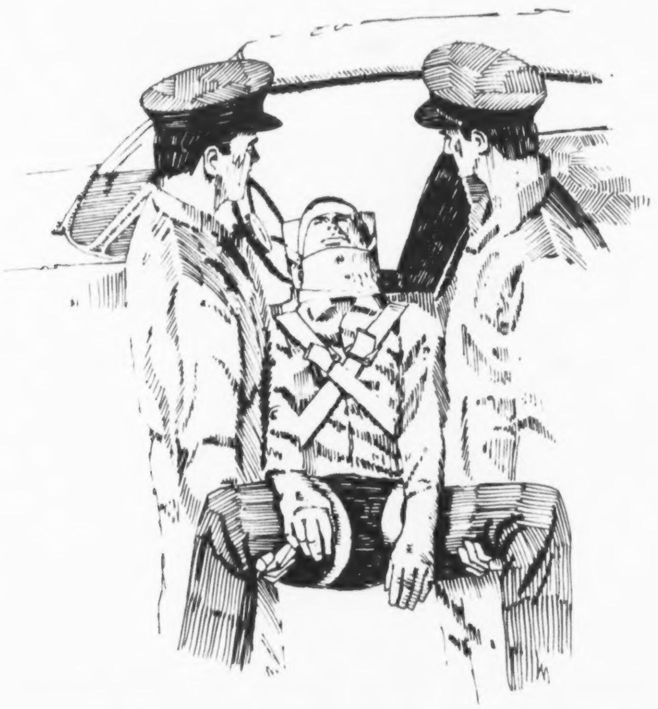


FIGURE 25. The victim is now ready for removal. For a large victim, it is recommended that he, be secured to the short board, be pivoted in the seat and put on a long board for removal, similar to the procedure shown in Figures 16, 17 and 18.



← FIGURE 26. A victim that can be handled by squadmen can be removed by lifting him out secured to the short board as shown. The squadmen must hold the victim high up under to keep him from sagging on the board. The squadman's other hand grasps the board at the top hand holes.

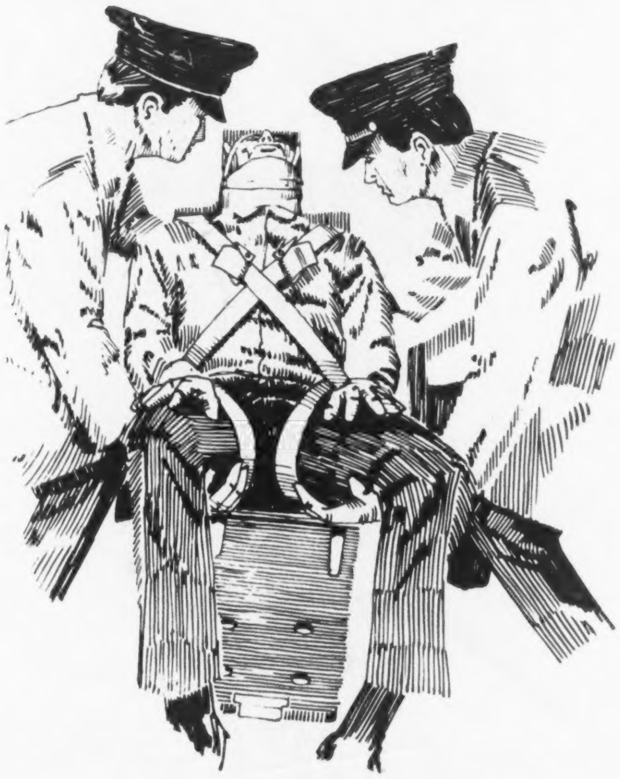
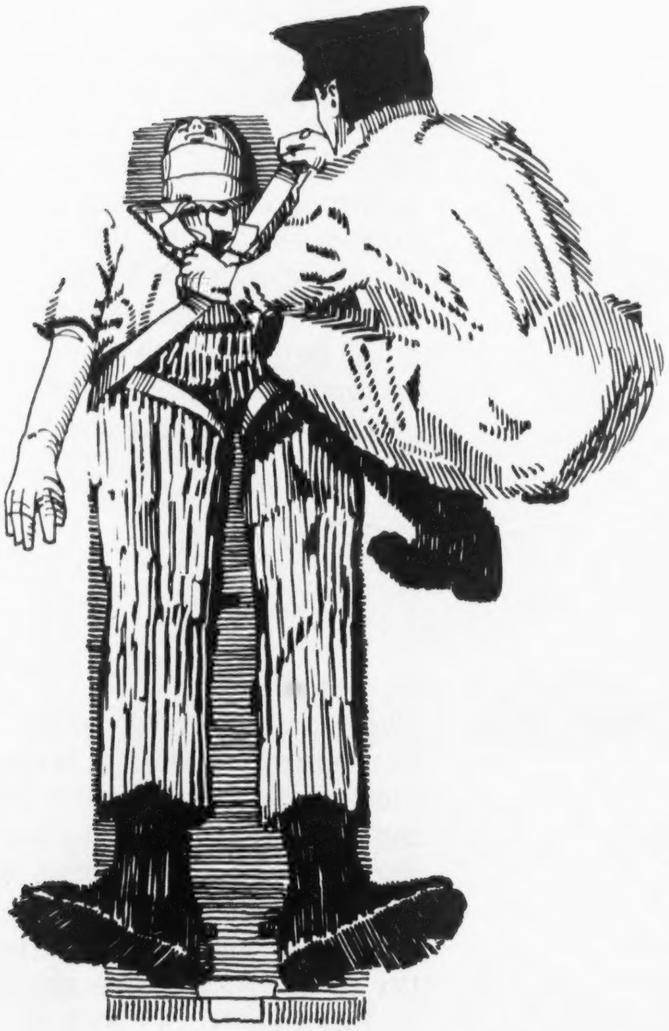


FIGURE 27. The victim can now be placed on a long backboard. The chest straps must be loosened so that the legs can be extended.



← FIGURE 28. The victim and the short board are both secured to the long board. The victim is now ready for transportation.

REMOVAL FROM UNDER DASHBOARD

A victim might typically be found in the position shown in Figure 29. Four squadmen will be needed, to remove him.

After the victim is given emergency care, a board is placed on the front seat. (See Figure 30.)

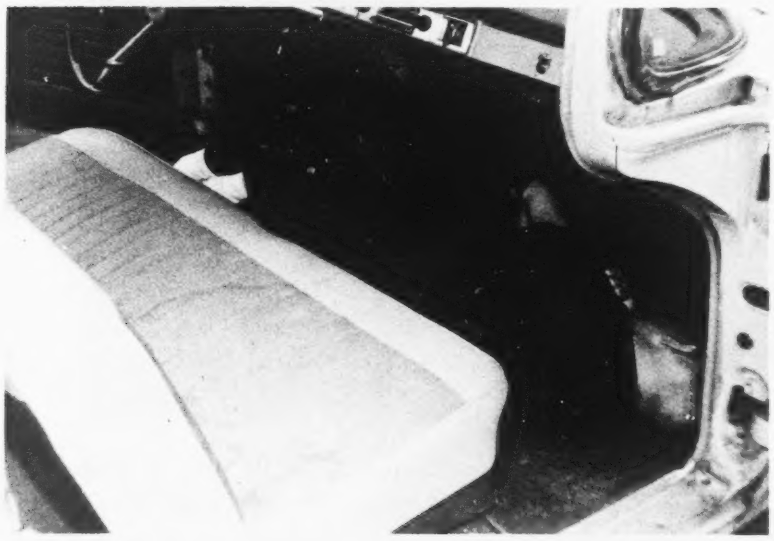


FIGURE 29

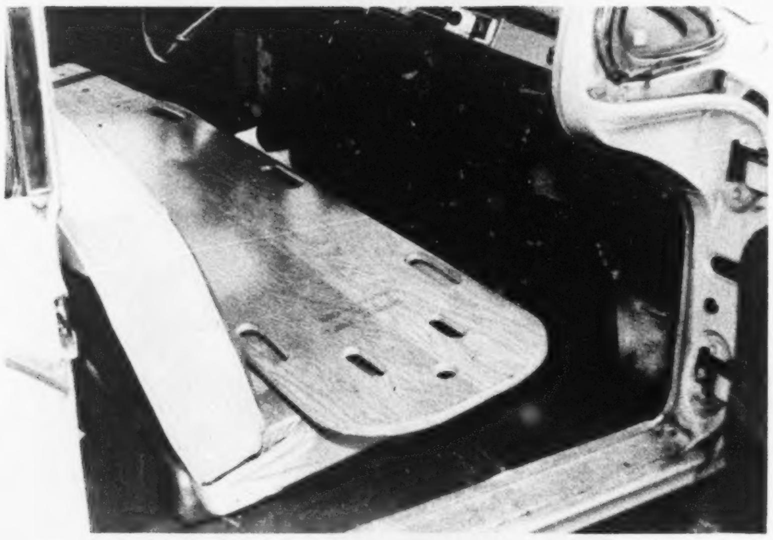


FIGURE 30

Figure 29 shows a victim lying under the dashboard of an auto. Squadmen, after giving him emergency care, will place a backboard on the front seat as in Figure 30.

Then the rescuers prepare to roll the victim onto the board, as follows:

1. One squadman places himself so that he can support the victim's head. He controls its movement at all times during the maneuver.

2. One squadman places himself where he can support the victim's legs.

3. Two squadmen get into the back seat, reach over the front seat, and grasp the victim's clothing at the shoulder, chest, belt, and thigh. (See Figure 31.)

On a signal all four squadmen gently lift the victim, keeping his back and hips against the front of the front seat. (See Figure 32.)

The victim is then placed on the board. (See Figure 33.)

The victim on the backboard is slid out of the car. (See Figure 34.) He can be transferred to the squad stretcher.

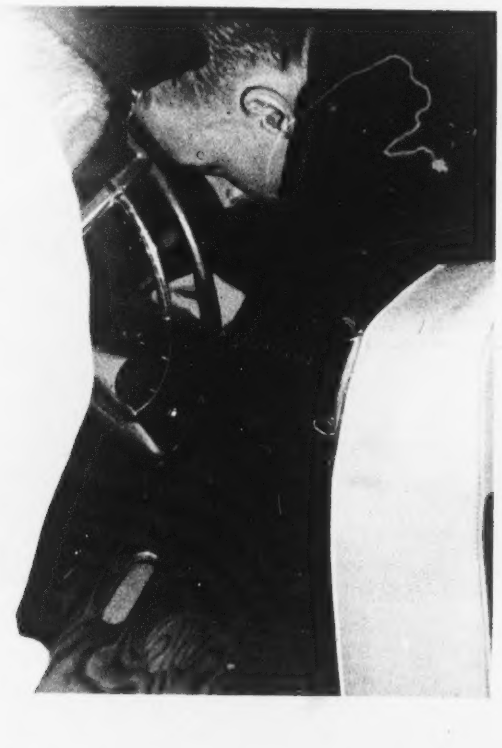


FIGURE 31. Squadman at left is attending the victim's legs. Squadman at right, reaching from the back seat, is grasping the victim's belt and thigh.

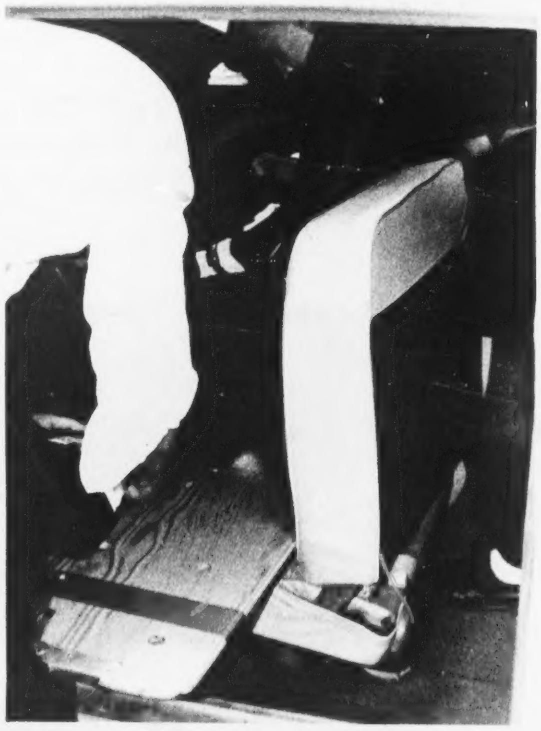


FIGURE 32. Four rescuers lift the victim from the car floor. One man in back, not visible here, holds the victim's chest and shoulder. Another is outside the car on the opposite side.

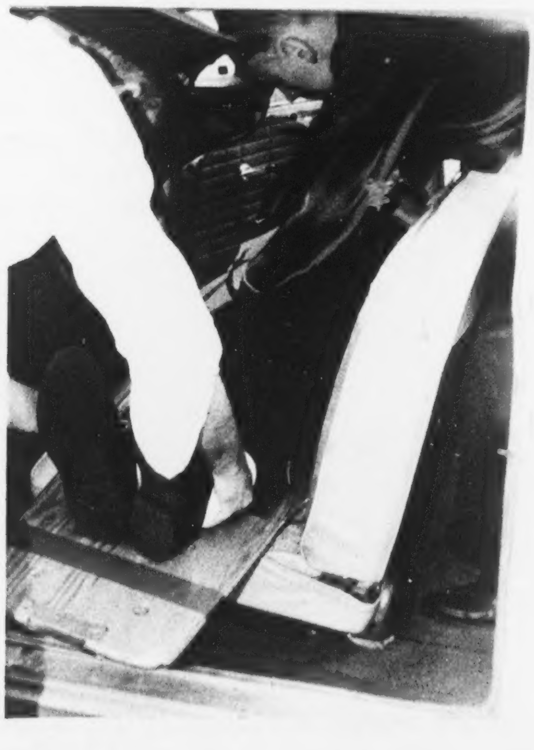


FIGURE 33. The victim is slid on a backboard.

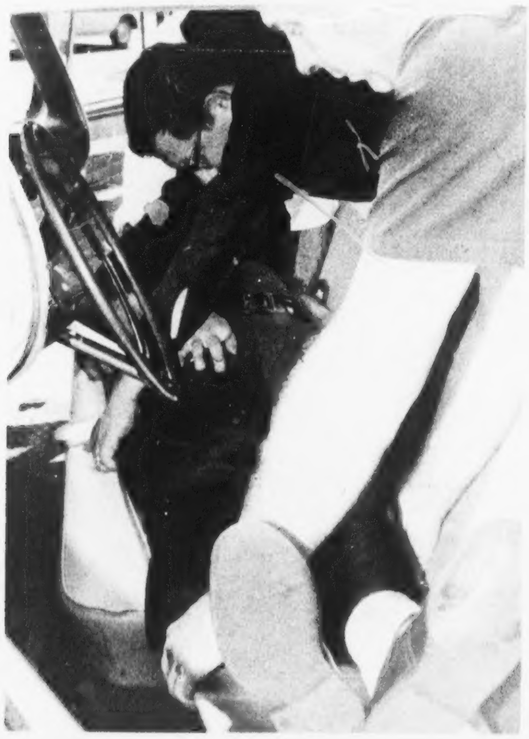


FIGURE 34. The victim, on the board, is removed from the car.

REMOVAL FROM FRONT SEAT

Many times a victim is injured and falls across the front seat.

Four men are also needed for this rescue procedure, as follows:

1. Two men get into the back seat. The top man supports the victim's head and grasps the clothing at the shoulder. The second man grasps the victim's clothing at the belt and thigh. (See Figure 35.)

2. One man outside the car prepares to guide the victim's feet.

3. One man handles the board. Later he will attend the victim's head.

The victim is rolled slightly away from the back of the seat, and the board is slid behind him. (See Figure 36.)

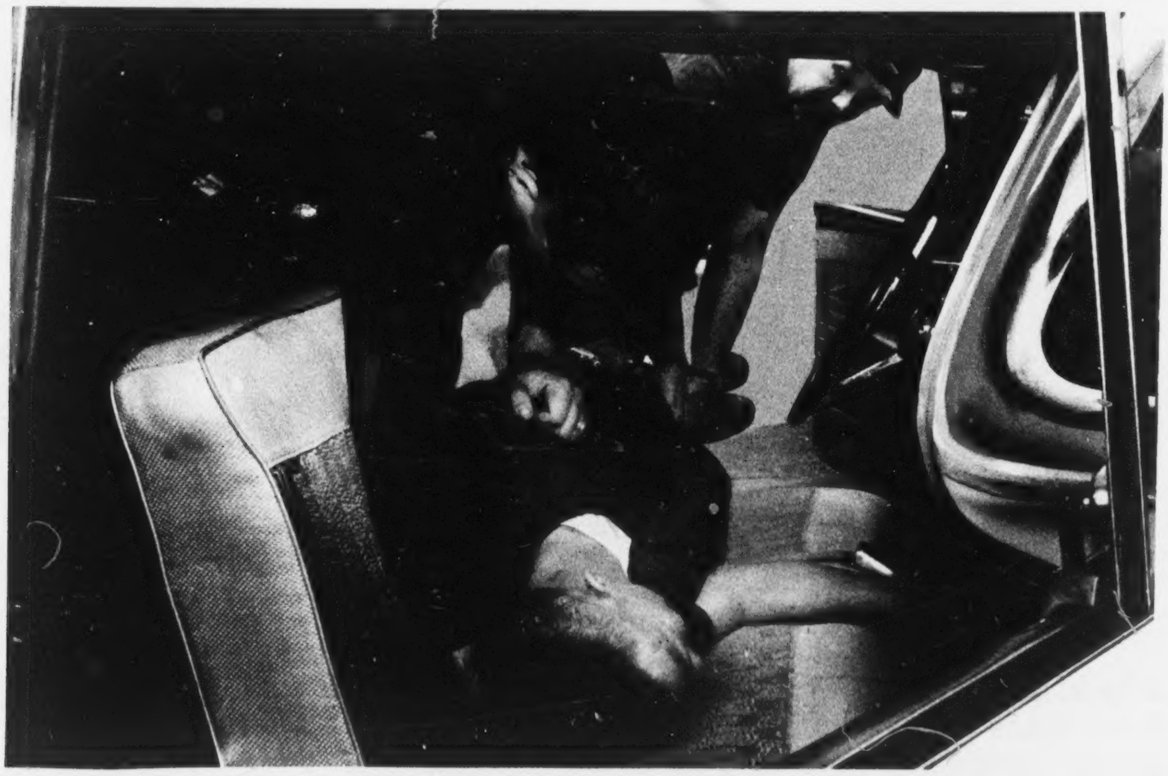


FIGURE 35. Rescuers are preparing to move the victim. Note positions of each squadman's hands.

After the board is in place, the man who handled it becomes top man. He supports the head of the victim against the board with his arm, and grasps the bottom edge of the board. (See Figure 37.)

The two men in the back seat then reach across the victim, grasping his clothing under the ribs, waist, hip, and thigh. Together they hold the victim snugly against the board. (See Figure 37.)

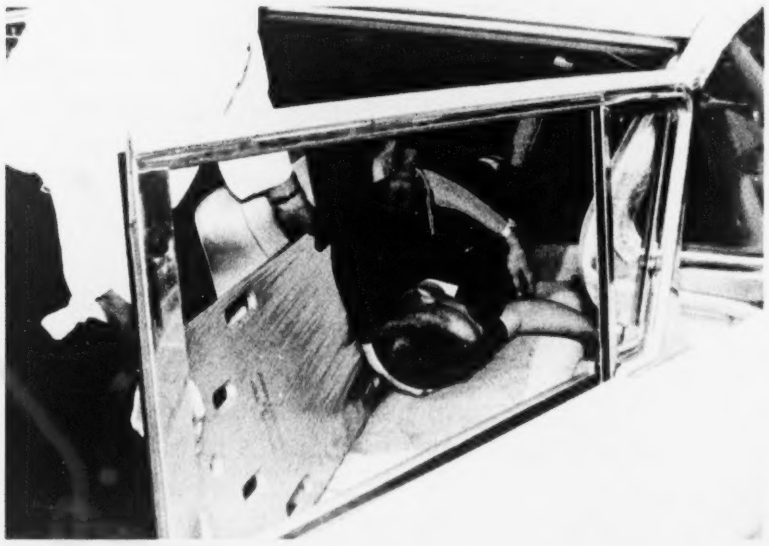


FIGURE 36

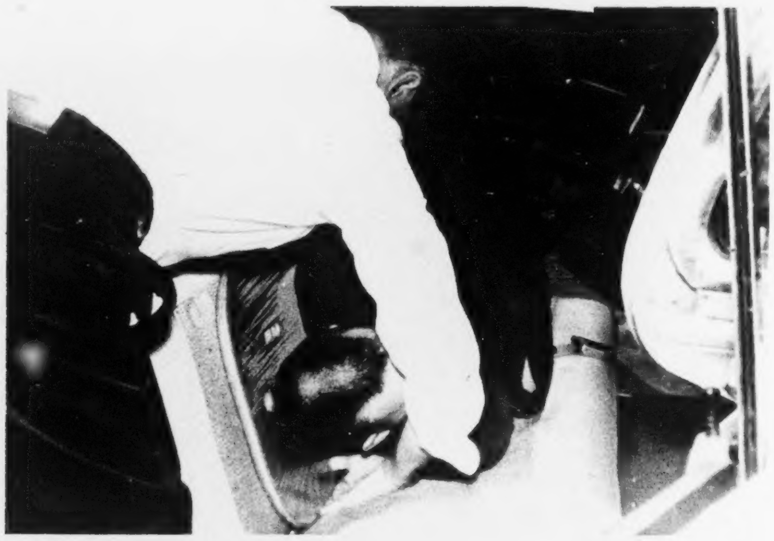


FIGURE 37

The victim is slightly rolled while one man places a board behind him (Figure 36). One squadman holds the victim's head against the board with his lower arm, as his hand grasps the backboard edge (Figure 37).

The bottom man (on the outside of the car) grasps the top of the board with his top hand. He reaches around the victim's ankles and grasps the board at its bottom edge, at the same time keeping the victim's feet against the board. (See Figure 38.)

On a signal all four men turn the board, keeping the victim tight against the board. (See Figure 39.)

The board is now resting on the front seat. The victim can be removed as previously shown.

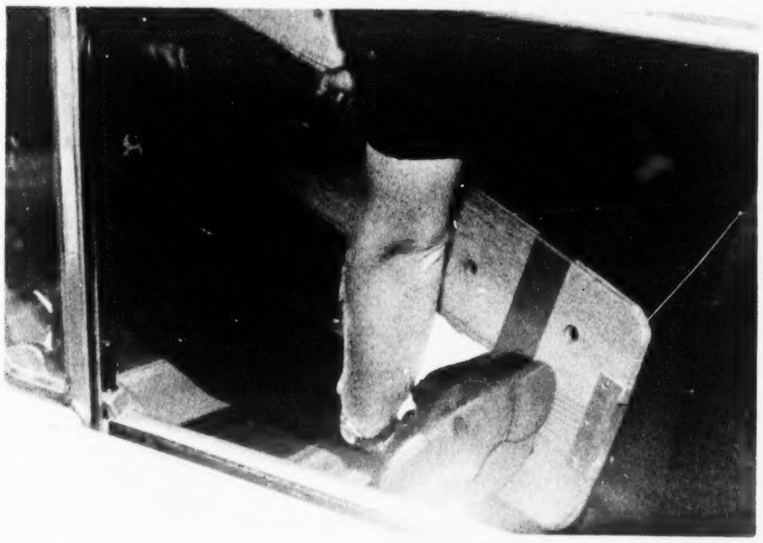


FIGURE 38

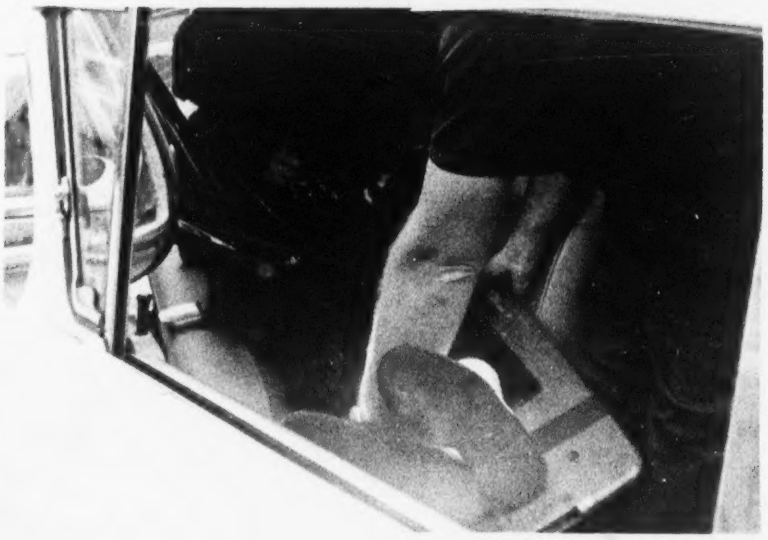


FIGURE 39

With his left hand another squadman grasps the backboard below the victim's ankles (Figure 38). His right hand grasps the hand hole. Lowering the board onto the car seat is a joint maneuver (Figure 39).

REMOVAL FROM THE BACK OF CAR

People riding in the rear seat of a car can as easily be injured in a wreck as those in the front seat. They sometimes are found in the position shown in Figure 40.

To remove this victim, four squadmen grasp him using the same hand position as those shown in Figure 35. However, the two squadmen in the car are in the front seat. These two men grasp the victim as shown in Figures 41 and 42.

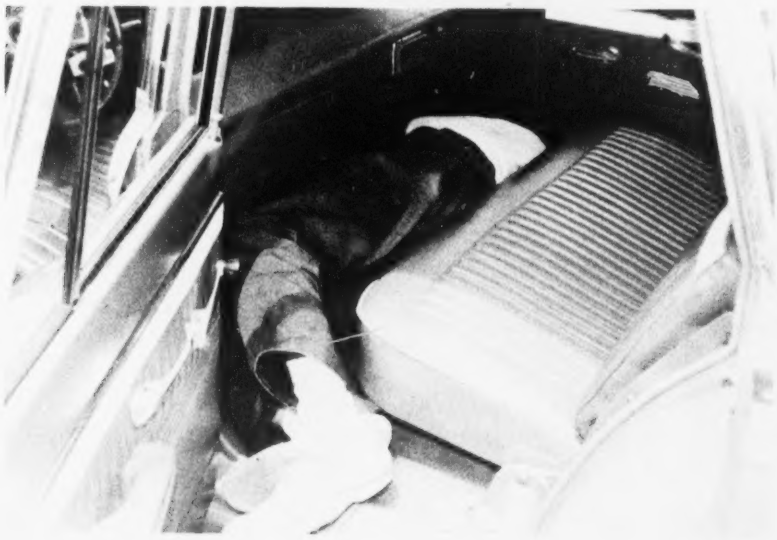


FIGURE 40

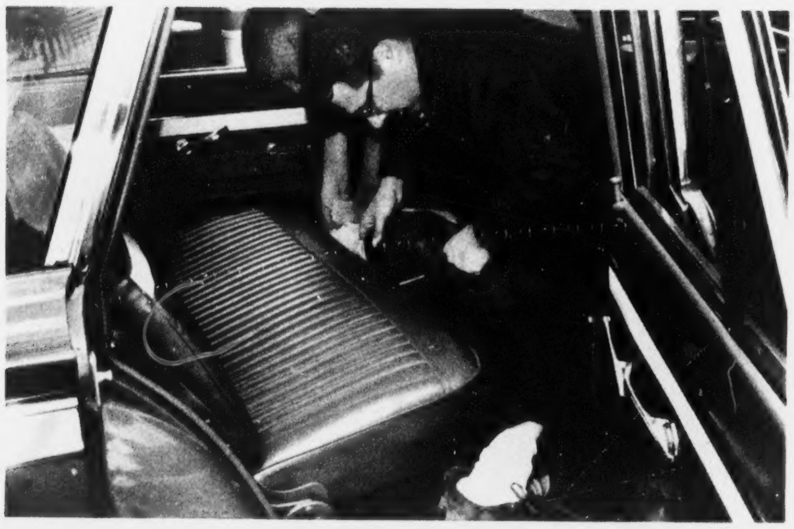


FIGURE 41

A victim lies on the floor between the front and back seats (Figure 40). Two squadmen, working from the front, grasp the victim as in Figure 41.

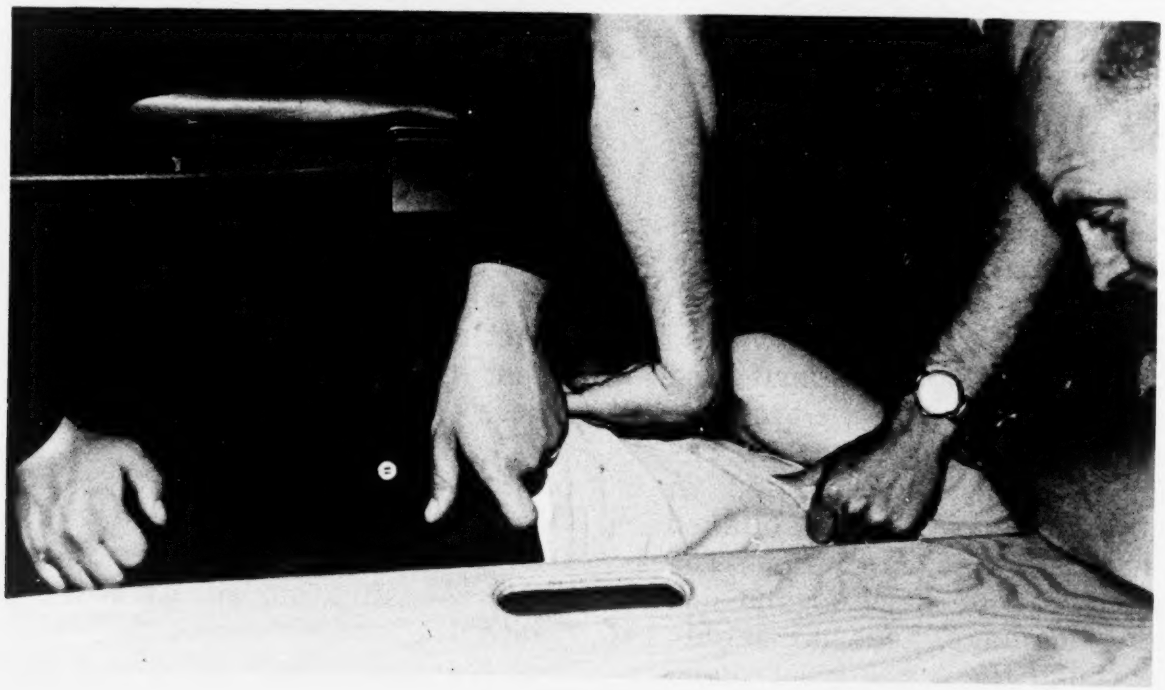


FIGURE 42. Squadmen place their hands on the victim as shown.

A board is placed on the seat and the victim is raised to the board. His back should be kept against the front of the back seat as support. His head, neck, legs, and back must be continually supported.

The back seat can be removed and the board put on the floor. The victim can then be supported and logrolled onto the board more easily. (See Figure 43.)

FIGURE 43. Rescuers place the victim on the board. In this view, the back seat has been removed from the car. ➔

MULTIPLE VICTIM REMOVAL

It is not uncommon to arrive at the scene of an automobile accident and find three or four injured victims in the vehicle.

Once the size up has been made and emergency care applied to the victims, it is then necessary that they be removed from the wrecked vehicle. A general procedure has been established in Figures 44, 45, 46, and 47. The vehicle is a two-door hardtop and due to the assumed damage, access can only be made through the right front door. The point to be made is that the removal of one victim clears the way for the removal of the next.

The preceding situation cannot be established as a hard-fast rule or method, but presented only to serve as a guide and a reminder that all accident victims must be handled carefully and that removal should in no way aggravate existing injuries.

No two auto accidents are identical, and the situation at the scene will dictate the proper method. The ability of the emergency personnel to size up the situation and to exercise their initiative with a "cool level head" will result in successful extrication of the injured.

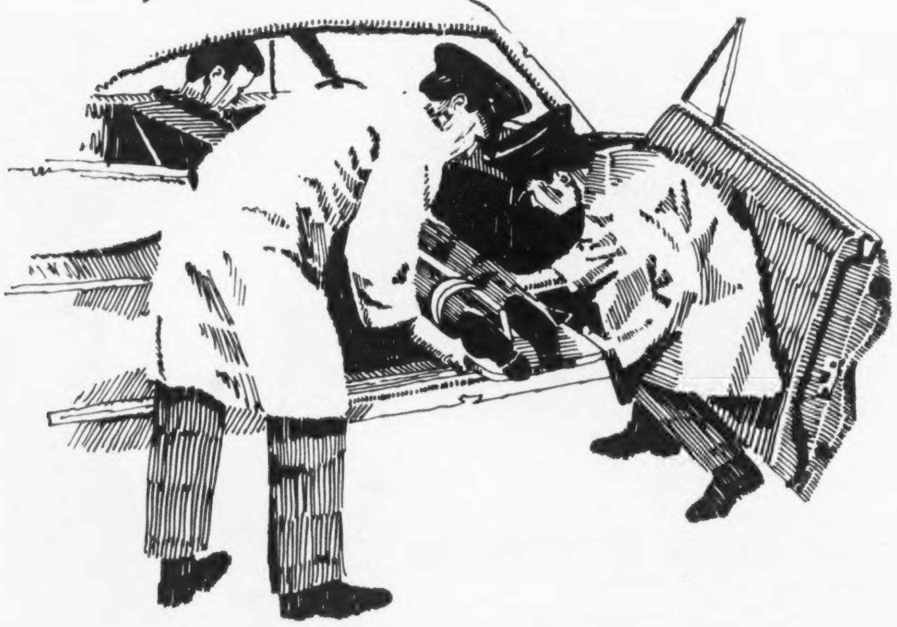


FIGURE 44. The passenger in the right front seat is removed first. He has been given all necessary care and is being removed on a backboard.

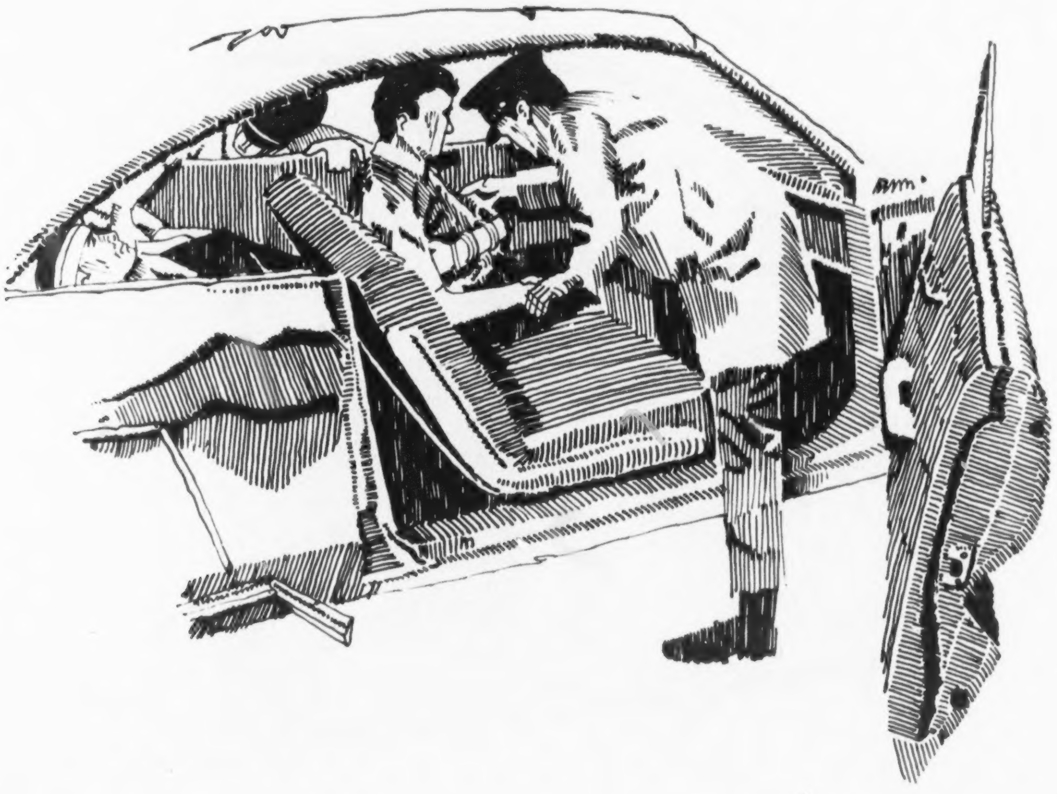


FIGURE 45. The driver is removed next. All injuries have been dressed and a splint has been applied. Notice that a squadman is reassuring the victims in the back seat.

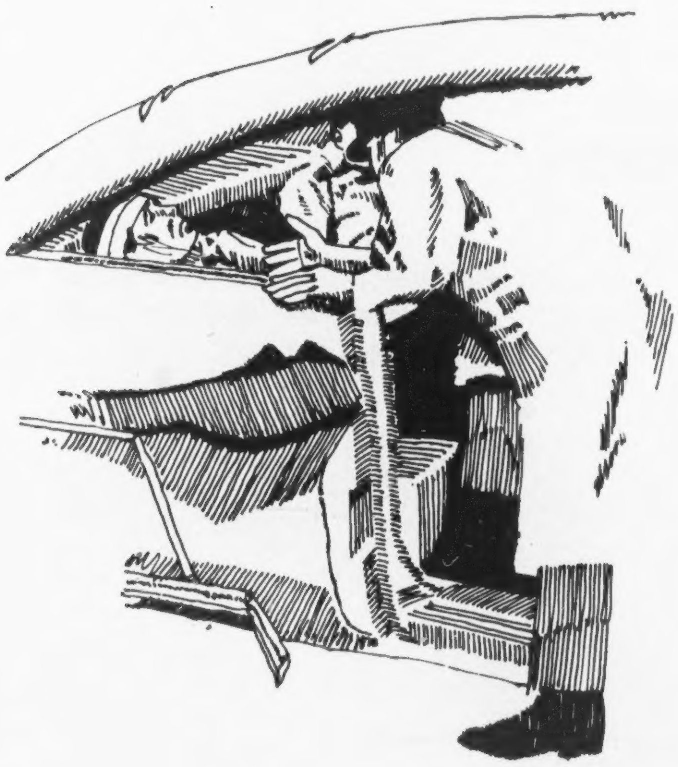


FIGURE 46. The front seat is now clear. Additional victim care is administered. The front seat is slid forward and the seat backs tilted down, providing room to apply splints or use a backboard. The passenger in the right rear seat will be the third victim to be removed.

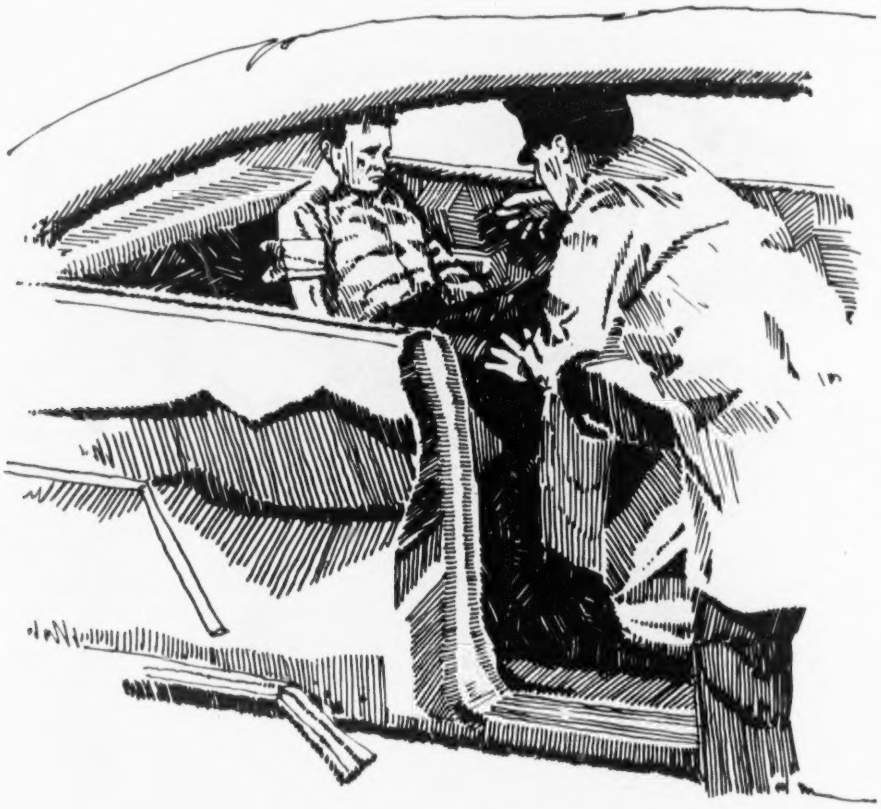


FIGURE 47. The fourth victim in the left rear seat is the last to be removed. He has been reassured throughout the entire procedure. The method of removal will be according to the extent of injury. If necessary, a backboard will be used, etc.

CONCLUSION

A wrecked car should be obtained by every squad, and it should be used often at drills to practice removal of victims. The car can be turned on its side or top, and the victims can be brought out through side windows, and through the windshield or back window.

Figures 14, 15, 16, 17, 18, 29 through 43 – were taken in cooperation with the Sharon Township Fire Department, Worthington, Ohio.

CHAPTER XXVII

ELECTRICAL EMERGENCIES

INTRODUCTION

A squadman is not presumed to be an electrician nor an electrical lineman, but his duties may require him to face situations involving electrical equipment or wiring. Therefore he should be able to recognize electrical hazards and should know the proper action to take.

Saving property alone never justifies the risk of a man's life. Where life is involved, the urgency is greater; necessity prompts the squadman to act in the face of great danger. However, he should THINK before he ACTS. Moreover, unless he KNOWS what he is doing, he should seek help from a qualified person. Electrical power has become so common that facilities for supplying electricity are present in almost every part of every community. Emergency squad personnel can prepare themselves to deal with electrical hazards by learning methods for handling electrical equipment and wiring.

The information in this chapter is merely suggestive. It is the responsibility of the department head, or the emergency squad officer, to reach an agreement with the appropriate officials of the local power company as to procedures to be followed in an emergency involving the company's property and equipment, or any other property where electrical equipment or wiring is concerned. All squadmen, and all power-company employees who are subject to call when an emergency occurs, should be thoroughly familiar with whatever procedure has been mutually approved. In many cities a power-company unit responds to each emergency where electrical hazards may be encountered. Regardless of this policy, someone must call the power company immediately when any emergency involves electrical hazards within the company's area. The squadman requesting assistance from the power company must clearly inform the receiver of the call as to the electrical equipment involved (transformer, overhead wires, underground cables, etc.) and its location. This will facilitate service and make for maximum cooperation.

RECOGNIZING THE DANGER

All wires are potentially dangerous. Fallen, energized wires are an extreme hazard to anyone who is not familiar with electrical behavior in wires under the stress of a ground or short circuit. The actual threat to life is determined by the amount of current or amperage that flows through a person's body.

The pressure applied to cause a current or amperage to flow is called voltage. Under some circumstances, a very low voltage can send enough current through a person's body to cause serious injury or death. This is particularly true if the person is standing on the ground or on a well-grounded structure. The flow of current is from a wire to the ground. Anything or anyone within this path may become the conductor for the current from the point of contact on the wire or electrically charged object to the point of contact on the ground.

CHARGED GROUND NEAR A FALLEN WIRE

It is dangerous even to approach a fallen wire. Distribution or transmission wires, in particular, may energize the ground for a considerable area around the point where they make contact. It is impossible to give specified rules or distances, since the danger area will vary with the voltages involved and with ground conditions. The hazard is much greater during damp or rainy weather.

CIRCUIT BREAKERS

Wires lying on the ground may be de-energized one moment and energized the next. While energized they may whip around, and this is an additional hazard. Self-operating devices protect most power systems from surges and grounds. These devices open a circuit when it is overloaded or shorted and then, in a matter of seconds, automatically close the circuit. The setting on this equipment may vary from one to four seconds.

INVISIBLE DANGER

Energized wires lying on the ground or across a vehicle may show no evidence of being live, yet touching the wire or the vehicle may be fatal. If an electric wire should fall across a fence or telephone wire, they are as dangerous as the live wire itself and the same precautions must be taken.

ACTING IN AN EMERGENCY

The only completely safe thing to do with fallen wires is to stay clear of them and call the power company. In some cases, however, waiting for the power company crew may mean the difference between life and death. Therefore, it is essential for emergency squad personnel to have a reasonable working knowledge of the electrical hazards and emergency situations that may confront them in each community they service.

If wires are down, on arrival at an emergency proceed as follows:

Radio for the power company and move the crowd back from the danger zone (at least one span each way from the break or the sagging wire.) This is necessary for several reasons.

1. The spans of wire adjacent to the trouble may have been weakened.

2. Any movement of the wires in trouble, caused by the wind or rescue work, may burn other wires down.

3. Wires on the ground may burn through at some point and the ends may curl up, roll along the ground, and cause injury to someone.

4. Burns, electric shocks, or eye injuries from electric flashes may occur even though a person is not in direct contact with the wires. Therefore, do not permit anyone to stand near weak or broken wires.

EMERGENCIES INVOLVING VEHICLES

In case of a motor vehicle, the rubber tires may insulate the vehicle from the ground, so that although the vehicle itself may be charged, there will be no current flowing from the vehicle to the ground. In such case, passengers in the vehicle will be relatively safe if they remain in it. A person touching the vehicle while standing on the ground will complete the circuit from the vehicle to the ground, creating a path of current flow through his body which can often prove fatal.

An example is that of a woman whose car became energized from a fallen wire as the result of hitting a light pole. In her fright, she jumped out of her car. After moving away from the car, she realized she had left her purse on the seat of the car. She returned to the car and, upon touching the door, was instantly electrocuted.

Charged Emergency Apparatus

A person will be relatively safe providing he DOES NOT make contact with the apparatus and the ground at the same time. If the equipment is believed to be in contact with a live wire, and you must get off, DON'T STEP OFF - JUMP OFF. Your hands, feet, and body must clear the vehicle completely before you touch the ground. From the moment that you contact the ground, you must not again touch the vehicle.

HANDLING ENERGIZED WIRES

If a dry rope is thrown from a reasonable distance over wires carrying high voltage, the person throwing it will not be harmed. If the rope is wet when placed in contact with energized wires, the man can receive a shock which may prove fatal.

Polypropylene rope is completely non-conductive. It will not absorb moisture. This type of rope is ideal for use with electrical hazards.

ROPE-AND-WEIGHT TOOL

If action is necessary to remove a wire from a victim, a rope-and-weight tool can provide a means to handle wires safely in any weather. However, the squadmen must be thoroughly trained in its use. Men who can throw the weights efficiently will be able to pick up a live wire with relative safety, regardless of the position in which it falls.

This rope tool consists of two weights, each weighing approximately one-half pound, attached one to each end of a 100-foot, one-quarter-inch rope. (See Figure 1.) The rope must be free of any metallic substance, to be safe in use. Any emergency unit can make this device for little cost. It is recommended that one be in service on each unit in operation.

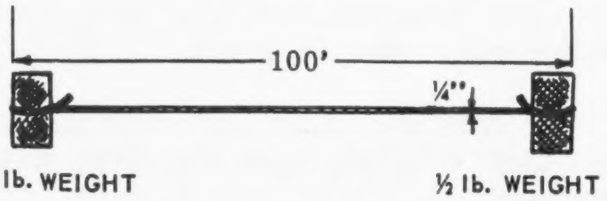


FIGURE 1. Tool made with rope and two weights, for handling live wires

USING THE ROPE

Emergency squadmen should be trained in the use of the weighted rope. Only practice can make them proficient in handling live wires safely in this manner.

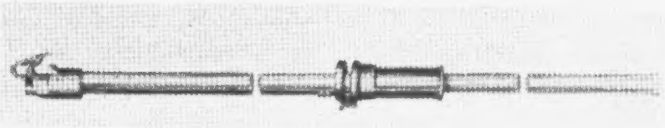


FIGURE 2. Hot stick

With this tool a squadman can gain control of a fallen wire without getting near the wire. After the rope is in contact with the wire, approved and adequate insulating equipment will allow him to move the wire by pulling on the rope. A pair of approved lineman's rubber gloves and glove protectors, and a lineman's "hot stick", tested for use on high voltage, are required. (See Figure 2.) With this equipment the wire may be moved as follows:

1. Clear all persons out of the danger area, as described earlier.

2. Put on lineman's rubber gloves and glove protectors.

3. Stand opposite the point to which you want to move the wire and approximately thirty feet from the wire.

4. Toss one end of the weighted rope under the wire to a point about equal to your distance from the wire, on the other side. (See Figure 3.)

5. Toss the other end over the wire so that it lands near the first weight thrown.

6. Pick up the two weighted ends with the hot stick, and drag the wire out of the way. (Be sure the wire is guarded.)

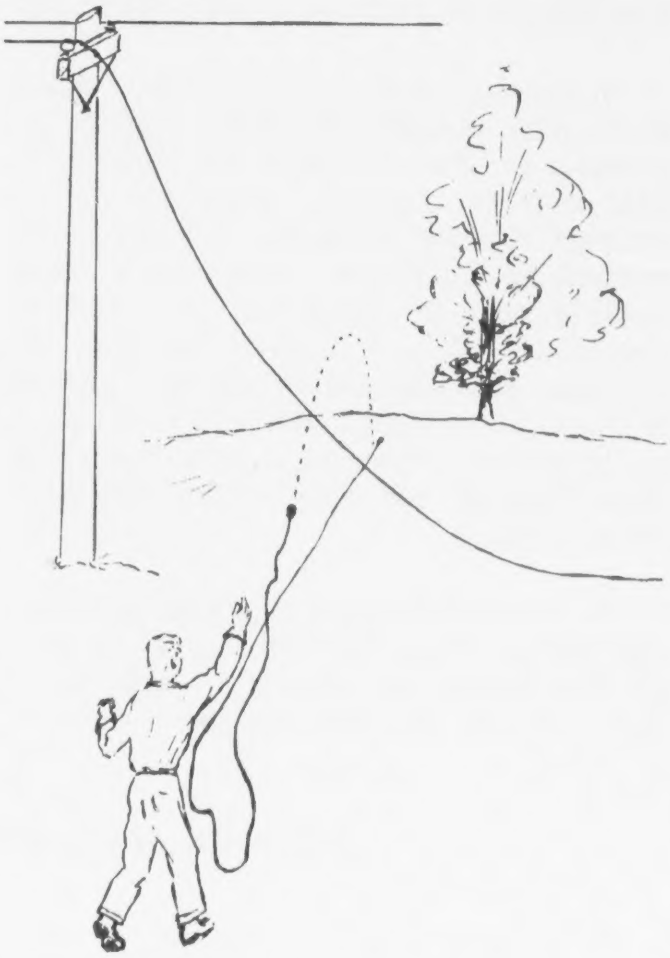


FIGURE 3. Man throwing rope with weights

7. Keep in mind at all times that the ground may be energized for some distance around the fallen conductor.

It must be remembered that any fallen wire is dangerous and that it can mean instant death to the poorly trained emergency rescue squadman. However, when a human life is involved, squad personnel will have to take immediate rescue action. In such situations the action taken will be founded on past experiences and training. Here every second counts, yet caution must be exercised so that the seriousness of the original emergency is not increased because of the overzealous action taken by a squadman or other person nearby.

HOT STICKS

Hot sticks are specially designed tools used principally by electric company linemen to manipulate energized conductors into a desired position. They are specially treated by the manufacturer to prevent moisture from penetrating the wood. They should be kept in a compartment or other container on the rescue truck to prevent damage while in storage. They should be inspected at regular intervals by someone who knows their construction even if they have not been used since the last inspection.

REMOVING VICTIM FROM WIRE

When a person is found lying on an energized wire, and the wire is not entangled around the victim, a quick method to rescue him is to employ a hot stick to push or pull him from the wire. While the victim is being removed from an energized line he may receive additional burns, but this is not as serious as having him remain in contact with the energized conductor.

The rescue worker should stay as far away from the victim or the wire as the hot stick will permit. If additional help and another hot stick are available, they may be employed in the rescue operation. One man may hold the live wire immobile while the other man moves the victim from contact with the wire. This additional assistance can prevent the end of a live wire from whipping in a manner similar to that of an unattended garden hose that is discharging water from an open nozzle. Also, by keeping the wire in contact with the ground, the exposure of a victim to additional shock and burns is kept to a minimum.

In cases where hot sticks are not available, an alternate procedure may be applied.

Use a long, dry rope (of a type referred to in Figure 1) to loop around some part of the victim's body in a manner that will permit dragging the victim from the danger area. This alternate procedure may require the squadman to perform the rescue operation from a position much closer to the victim and/or the wire than the maximum distance allowable when hot sticks are employed. Here the rescue worker must perform this act, taking all necessary precautions to prevent his body or clothing from making contact with the victim's body, or clothing, or the wire itself. These precautions are necessary until the victim has been removed from the danger area. Bystanders should be ordered to remain at least a minimum of one hundred feet away from the victim. This will prevent them from coming into contact with anything which may be energized, thus eliminating the chance of additional victims.

EMERGENCY CARE AFTER RESCUE

In cases where artificial respiration is required, it should be started at once after the victim has been released from contact with the wire. Resuscitation should continue until the victim has recovered or until a member of the medical profession has pronouned him dead. The treatment of any burns from electric shock should be the same as that described for any burn case.

Closed - chest heart compression may also be needed. The signs that establish when to start this procedure are described in Chapter X, "Closed -Chest Heart Compression".

CHAPTER XXVIII

RADIATION ACCIDENTS

INTRODUCTION

Emergency handling of radiation exposure or radioactive contamination cases should not be feared. The handling of these cases is a matter involving common sense, cleanliness and good housekeeping.

Radiation can be detected and measured by a simple instrument--a survey meter. Radiation accident problems have parallels in other conditions handled frequently by emergency rooms and rescue squads without concern and following simple rules. Your group, your hospital can be involved. There are a few things you should know.

There are four types of radiation accident patients. The individual who has received whole or partial body external radiation may have received a lethal dose of radiation but he is no hazard to attendants, other patients or the environment. He is no different than the radiation therapy or diagnostic X-ray patient.

Another type is the individual who has received internal contamination by inhalation or ingestion. He also is no hazard to attendants, other patients or the environment. Following cleansing of minor amounts of contaminated material deposited on the body surface during airborne exposure, he is similar to the chemical poisoning case such as lead. His body wastes should be collected and saved for measurements to assist in determination of appropriate therapy.

External contamination of body surface and/or clothing by liquids or by dirt particles presents a third type, with problems similar to vermin infestation. Surgical isolation technique to protect attendants and cleansing to protect other patients and the hospital environment must take place to confine and remove a potential hazard.

When external contamination is complicated by a wound, care must be taken not to cross-contaminate surrounding surfaces from the wound and vice versa.

There are a few simple rules (Standing Orders) to follow:

STANDING ORDERS FOR EMERGENCY HANDLING OF RADIATION ACCIDENT CASES

EMERGENCY SQUADS

Ambulance-emergency squad personnel are usually the first persons of the medical team to see the case of radiation exposure or radioactive contamination. Their first acts will vary in degree whether they evacuate the victim(s) from a nuclear-energy plant or from a university or medical group regularly working with nuclear material or from a road transportation accident. Trained, knowledgeable co-workers, supervisors or health physicists are usually on hand at the plant but not at the road site.

When the accident has occurred at a plant, the health physicist, supervisor, co-workers and the victim(s) should be able to inform members of the emergency squad of the nature of accident, number of victims and type of radiation exposure or radioactive contamination involved and possible body areas that may be affected. A gross measurement of the amount of radiation involved may be available; such information is most helpful.

It is the responsibility of the emergency squad to:

For the Victim:

1. Give lifesaving emergency assistance if needed.

2. Secure pertinent information including rough measurement from those in attendance.

3. Determine if physical injury or open wound are involved. Cover wound with clean dressing; use bandage to hold wound-cover in place; do not use adhesive.

4. Cover stretcher, including pillow, with open blanket; wrap victim in blanket to limit spread of contamination.

5. Notify hospital by radio or telephone of available information.

For Emergency Squad Personnel:

6. Perform survey of clothing, ambulance, etc., on arrival at hospital before undertaking further activity.

7. If contaminated, discard clothing in container marked "Radioactive--Do Not Discard." Cleanse self by washing and/or showering, as appropriate.

8. If in contaminated area, emergency squad personnel must be surveyed by radiation-survey meter; measurements must be recorded. Cleansing must continue until responsible physician indicates person may leave.

EMERGENCY ROOMS

STANDING ORDERS for physicians, nurses and hospital administrators are reproduced as follows:

It is the responsibility of the senior hospital emergency room person on duty, on receipt of notification of the momentary arrival of a case involving radiation exposure or contamination, to:

1. Notify responsible staff physician or nurse and aides (trained health physicists or trained technicians from X-ray or nuclear-medicine departments) if available.

2. Get appropriate survey meter, if one is on hand in the hospital. If hospital has no meter, notify hospital administrator or responsible hospital official so he may obtain survey meter and other pertinent equipment by calling the fire department, or police department.

3. Notify the hospital administrator so he may seek expert professional consultation for technical management of the case.

4. If contamination is suspected, prepare separate space, using either isolation room or cubicle if available. If such is not available, cover floor area immediately adjacent to emergency room entranceway with absorbent paper--the area to be adequate for stretcher-cart, disposal hampers, and working space for professional attendants. Mark and close off this area; be prepared to shut off air-circulation system.

On ambulance arrival, the physician and/or nurse in the emergency room should:

1. Check victim on stretcher for contamination (as stretcher is removed from ambulance), by use of survey meter.

2. If seriously injured, give emergency lifesaving assistance immediately.

3. Handle contaminated victim and wound as one would a surgical procedure, i.e., gown, gloves, cap, mask, etc.

4. If possible external contamination is involved, save all clothing, bedding from ambulance, blood, urine, stool, vomitus, and all metal objects, i.e., jewelry, belt buckles, dental plates, etc. Label with name, body location, time and date. Save each in appropriate covered containers. Mark containers clearly "Radioactive--Do Not Discard."

5. Decontamination should start if medical status permits, with cleansing and scrubbing the area of highest contamination first. If extremity alone is involved, clothing may serve as an effective barrier and the affected limb alone may be scrubbed and cleansed. If body as a whole is involved or clothing generally permeated by contaminated material, showering and scrubbing will be necessary. Pay special attention to hair parts, body orifices and body-folds areas. Remeasure and record measurement after each washing or showering. If a wound is involved, prepare and cover the wound with self-adhering disposable surgical drape. Cleanse neighboring surfaces of skin. Seal off cleansed areas with self-adhering disposable surgical drapes. Remove wound covering and irrigate wound, catching irrigating fluid in a basin or can to be marked and handled as described in Rule 4 above. Each step in the decontamination should be preceded and followed by monitoring and recording of the location and extent of contamination.

6. Save attendants' clothing as described for victims. Attendants must follow the same monitoring and decontamination routine as recommended for the victims.

The senior administrator on duty should inform the AEC and other public officials, such as community and/or state health departments as appropriate, police and fire departments as indicated.

The physician in attendance in the emergency room, if confronted with a grossly-contaminated wound with dirt particles and crushed tissue, should be prepared to do a preliminary simple wet debridement. Further measurements may necessitate sophisticated wound counting detection instruments supplied by the consultant who will advise if further definitive debridement is necessary.

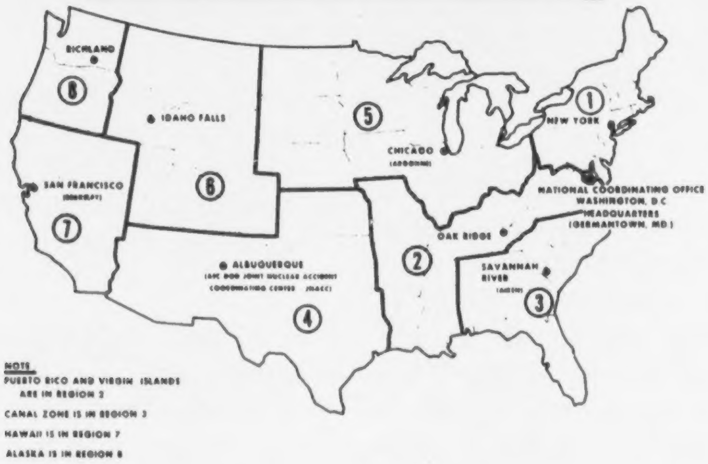
ASSISTANCE

May be secured from the U.S. Atomic Energy Commission's

REGIONAL COORDINATING OFFICES FOR RADIOLOGICAL EMERGENCY ASSISTANCE

Geographical areas of Responsibility are marked. Telephone and personal contacts with trained physician, specialist, technicians, laboratories, health physicists, public relations and information officer specialists are available.

UNITED STATES ATOMIC ENERGY COMMISSION
RADIOLOGICAL ASSISTANCE REGIONS AND COORDINATING OFFICES


RICHLAND
⑧
IDAHO FALLS
⑥
SAN FRANCISCO
(BERKELEY)
⑦
⑤
CHICAGO
(ARGONNE)
①
NEW YORK
NATIONAL COORDINATING OFFICE
WASHINGTON, D.C
HEADQUARTERS
(GERMANTOWN, MD.)
OAK RIDGE
②
ALBUQUERQUE
(AEC DOD JOINT NUCLEAR ACCIDENT
COORDINATING CENTER - JNACC)
④
SAVANNAH
RIVER
(AIKEN)
③

NOTE
PUERTO RICO AND VIRGIN ISLANDS ARE IN REGION 2
CANAL ZONE IS IN REGION 3
HAWAII IS IN REGION 7
ALASKA IS IN REGION 8

① 376 Hudson St.
N.Y., N.Y. 10014
212-989-1000

② P.O. Box E
Oak Ridge, Tenn. 37830
615-483-8611, Ext. 3-4510

③ P.O. Box A
Aiken, S.C. 29801
803-824-6331, Ext. 3333

④ P.O. Box 5400
Albuquerque, N.M. 87115
505-264-4667

⑤ 9800 S. Cass Ave.
Argonne, Ill. 60439
312-739-7711
(ext. 2111-duty hrs.)
(ext. 4011-off hrs.)

⑥ P.O. Box 2108
Idaho Falls, Id. 83401
208-526-0111, Ext. 1515

⑦ 2111 Bancroft Way
Berkeley, Cal. 94704
415-841-5121
(Ext. 664-duty hrs.)
(415-841-9244 off hrs.)

⑧ P.O. Box 550
Richland, Wash. 99352
509-942-1111, Ext. 6-5441

CHAPTER XXIX

POST MORTEM CONFERENCE

(ACTION EVALUATION)

INTRODUCTION

A post mortem conference is an evaluation of what has taken place during the course of an emergency.* It will point out what can be done in the future to expedite procedures and achieve a more efficient operation.

A definite pattern for scheduling post mortems cannot be established for all emergency units, as methods of operation within each department may differ.

WHY CONDUCT A POST MORTEM CONFERENCE?

In emergency squad work a, second chance to save a life is never guaranteed. However, an evaluation of past performance often yields information that will make the handling of future problems more efficient. Emergencies are not always routine, and squad procedures cannot always be spelled out in detail, in advance. If, during an emergency, something happens for which the squadman's training and instructions have not prepared him, he should not "pass the buck" afterward. Rather, he should welcome constructive criticism, opinions, advice, and ideas. He should treat this phase of squad work as one involving "fact finding", not "fault finding".

Pre-planning has been emphasized and referred to many times in this text. A combination of pre-planning and post mortems is essential to efficient operation. If a squad carries out post mortems conscientiously, mistakes made in the past will be the stepping stones to success in the future.

HOW TO CONDUCT THE CONFERENCE

Post mortems must be based on facts, not hearsay. The report on the case in question should always be used. Such a report should indicate action taken from the time the squad left the station until it returned to service. A review of this action should form the basis for the post mortem discussion. As materials are reviewed, new ideas which may be of value on future calls may be introduced for consideration and evaluation.

---

* The term post mortem as used in emergency squad work refers to a conference held to discuss any completed squad operation. It does not imply a death, as in the more restrictive medical use of the term.

These discussions must not reflect on the judgment of the squadmen involved. The officer in charge must stress the importance of honest, constructive criticism if he wishes to obtain the full cooperation of his men. The post mortem must be treated openmindedly by all concerned.

SCHEDULING A CONFERENCE

The time for conducting a post mortem must be arranged in compliance with the rules, regulations and methods of operation of the squad. In general, however, post mortems should be held as soon after the run as practical so that the facts will still be fresh in the minds of those who were involved in the emergency. In a paid department, it is usually possible to hold discussions immediately after the run is completed. The informal discussion, which often takes place in both paid and volunteer squads while equipment is being checked and cleaned, can be of much value. In paid departments, post mortems may be held at the time of the change of shifts. Often, run reports are reviewed by officer personnel going on and off duty.

Some volunteer squads have regular meetings where matters of interest and importance are thoroughly discussed. This is an excellent time to conduct the post mortem. Thus, personnel not on duty when the emergency took place can be filled in and briefed on the situation; their opinions and ideas can be evaluated.

In setting up a plan for carrying out post mortems, the results will justify the efforts expended.

Post mortems held in conjunction with training sessions are excellent proving grounds for techniques and methods which can be tried and practiced.

RESPONSIBILITY AND PARTICIPATION

The responsibility for post mortems rests with the person who is in charge of the squad or its operation.

The underlying purpose of a post mortem is to gain the most benefits for all personnel. At one time, the usual procedure was to include only the officer personnel in a squad. However, no officer is any more efficient - in a general sense - than the degree of efficiency of his men. Enlisting the cooperation of all personnel creates a feeling of trust and confidence resulting in a mutual net gain to all concerned. The surest way to gain a person's cooperation is to ask for his help. If a satisfactory conclusion or evaluation is to be expected, all personnel involved should have a part. They will be affected by most decisions regarding policy change or the need for training.

ITEMS TO BE EVALUATED

A pattern should be established and followed in conducting such a session. The following items should be covered:

1. Receiving the call

   a. Was there anything unusual about it?

2. Answering the call

   a. Was a different route taken?
   b. Was there an unusual traffic problem?

   c. Is there a better route?

3. On arrival

   a. Were there any unusual circumstances?

4. Care given victim

   a. What?

   b. When?

   c. How?

   d. Reaction of victim?

   e. Results of care?

5. Equipment

   a. What equipment was used?

   b. Was equipment in place?

   c. Was it in good working order?

6. Control of family and/or public

   a. Outstanding difficulties.

   b. Action taken to handle difficulties in control

7. Medical assistance

   a. Was physician called?

   b. Family or other physician?

   c. Success or failure in obtaining a physician

8. Transportation

   a. Problems encountered

9. Hospital

   a. Condition of victim

   b. Problems encountered at hospital

10. Law-Enforcement agencies

    a. Were they notified?

    b. Were there any problems with officers?

11. Actions that merit special praise

    a. Were there any regular personnel (medical, hospital, police) who made any extra or special effort to help the squad in meeting the emergency?

    b. Did the squad receive special help from a utility company, heavy equipment operator, etc.?

    c. Have any such personnel been thanked for their special cooperation?

CHAPTER XXX

LEGAL ASPECTS

INTRODUCTION

There are three main legal aspects of emergency care, (1) the responsibility and extent of administration of emergency care, (2) the responsibility for proper operation of the vehicle, and (3) the responsibility of the emergency medical personnel in relationship to the victim(s) and others.

This chapter contains only points of legal implications. The services of the city solicitor or county prosecutor should be obtained whenever local questions arise and legal interpretation is necessary.

LEVEL OF CARE

Emergency medical personnel must provide the level of care comparable to others engaged in the provision of emergency medical services. All skills and care will be administered up to, and not beyond, the level of training.

Equipment and facilities must meet the standards generally recognized and considered adequate by others similarly engaged in the administration of emergency medical care.

VICTIM(S) REFUSING EMERGENCY CARE

Any victim may decide for himself to accept or refuse emergency care. Emergency medical personnel may not force treatment on any person who does not wish it. The only exception is the victim who is incompetent and/or irrational. No victim may be confined or restrained against his will even if it is for his own good, unless he is felt to be incompetent or irrational. It may be a difficult task, but all emergency medical personnel must make every effort to identify the victim who is not capable of making his own decisions, and the victim who is fully capable of making his own determination, whether they be good or bad decisions.

OPERATION OF THE VEHICLE

The driver of the emergency ambulance, when responding to the scene or enroute to the hospital, must consider the safety of all on board the vehicle and others using the traveled roadway. The use of warning lights and sirens must be restricted to true emergencies. The driver must realize that he is primarily requesting permission to proceed at a constant speed and for movement with the flow of traffic, but not to constantly exceed posted speed limits or to violate other traffic regulations.

NOTIFICATION OF CORONER

When a person shall die under any of the following circumstances or as a result of the following causes, these deaths shall be reported to the coroner's office.

1. Accidental deaths
2. Homicidal deaths
3. Suicidal deaths
4. Abortions (criminal or self-induced)
5. Sudden deaths (when in apparent good health)
6. Any death in which there is a doubt, question, or suspicion

When reporting a coroner's case, give your name, and state "I wish to report a death." Give as much of the following information that is known:

1. Name and address of the deceased
2. Age
3. Marital status of the deceased
4. Race
5. Time of accident or onset of cause of death
6. Place and manner where the fatal injury was sustained
7. Place of death
8. Time of death
9. Location of the body
10. Any other pertinent information
11. Name of physician who pronounced the person dead

STATUTES

The following statutes taken from the Revised Code of the State of Ohio may serve as a reference for emergency medical personnel. It is not intended to be complete; and it will not serve as an interpretation to those questions that may arise at the local level. Remember, all legal interpretations should come from the city solicitor or county prosecutor.

SECTION 307.051. AMBULANCE SERVICE--COUNTY COMMISSIONERS

A board of county commissioners may provide ambulance service or may enter into a contract with one or more counties, townships, municipal corporations, or private ambulance owners, regardless of whether such counties, townships, municipal corporations, or private ambulance owners are located within or without the state, in order to obtain ambulance service, or to obtain additional ambulance service in times of emergency. Such contracts shall not restrict the operation of other ambulance services in the county.

When such service is provided by the board, the service may be administered by the board, by the county sheriff, or by another county officer or employee designated by the board. All rules and regulations, including the determining of reasonable rates, necessary for the establishment, operation, and maintenance of such service shall be adopted by the board.

A contract for such service shall include such terms, conditions, and stipulations as agreed to by the parties to the contract. It may provide for a fixed annual charge to be paid at the times agreed upon and stipulated in the contract, or for compensation based upon a stipulated price for each run, call, or emergency or the number of persons or pieces of apparatus employed, or the elapsed time of service required in such run, call, or emergency, or any combination thereof.

SECTION 313.11. NOTIFICATION IN THE CASE OF DEATH BY VIOLENCE OR SUICIDE

Any person who discovers the body or acquires the first knowledge of the death of any person who died as a result of criminal or other violent means, or by casualty, or by suicide, or suddenly when in apparent health, or in any suspicious or unusual manner, shall immediately notify the office of the Coroner of the known facts concerning the time, place, manner, and circumstances of such death and of any other information which is required by sections 313.01-313.22, inclusive, of the Revised Code. In such cases, if request for cremation is made, the funeral director called in attendance, shall notify the Coroner immediately. No person shall willfully refuse to report such a death, or shall, without an order from the Coroner, willfully touch, remove, disturb the body of any such person, or disturb the clothing or any article upon or near such body.

SECTION 313.12. NOTIFICATION BY PHYSICIAN IN CASE OF DEATH BY VIOLENCE OR SUICIDE

When any person dies as a result of criminal or other violent means, or by casualty, or by suicide, or suddenly when in apparent health, or in any suspicious or unusual manner, the physician called in attendance shall immediately notify the office of the Coroner of the known facts, concerning the time, place, manner, and circumstances of such death, and any other information which is required pursuant to Sections 313.01 to 313.22, inclusive, of the Revised Code. In such cases, if a request is made for cremation, the funeral director called in attendance shall immediately notify the Coroner.

SECTION 505.443. AMBULANCE SERVICE, TOWNSHIP TRUSTEES

In order to obtain ambulance service, or to obtain additional ambulance service in times of emergency, any township may enter into a contract, for a period not to exceed three years, with one or more townships, municipal corporations, or private ambulance owners, regardless of whether such townships, municipal corporations, or private ambulance owners are located within or without the state, upon such terms as are agreed to by them, to furnish or receive ambulance services or the interchange of ambulance services within the several territories of the contracting subdivisions, if such contract is first authorized by respective boards of township trustees or other legislative bodies.

Such contract may provide for a fixed annual charge to be paid at the times agreed upon and stipulated in the contract, or for compensation based upon a stipulated price for each run, call, or emergency, or the elapsed time of service required in such run, call, or emergency, or any combination thereof.

SECTION 505.45. SCHOOLING OF OFFICERS AND FIREMEN OF THE FIRE DEPARTMENT

The board of township trustees may send any of the officers and firemen of its fire department to schools of instruction designed to promote the efficiency of firemen, and, if authorized in advance, may pay their necessary expenses from the funds used for the maintenance and operation of such department.

SECTION 701.02. LIABILITY OF MUNICIPAL CORPORATIONS FOR OPERATION OF VEHICLES

Any municipal corporation shall be liable in damages for injury or loss to persons or property and for death by wrongful act caused by the negligence of its officers, agents, or servants while engaged in the operation of any vehicles upon the public highways of this state, under the same rules and subject to the same limitations as apply to private corporations for profit, but only when such officer, agent, or servant is engaged upon the business of the municipal corporation.

The defense that the officer, agent, or servant of the municipal corporation was engaged in performing a governmental function, shall be a full defense as to the negligence of:

(A) Members of the police department engaged in police duties;

(B) Members of the fire department while engaged in duty at a fire, or while proceeding toward a place where a fire is in progress or is believed to be in progress, or in answering any other emergency alarm.

Firemen shall not be personally liable for damages for injury or loss to persons or property and for death caused while engaged in the operation of a motor vehicle in the performance of a governmental function.

Policemen shall not be personally liable for damages for injury or loss to persons or property and for death caused while engaged in the operation of a motor vehicle while responding to an emergency call.

SECTION 737.21. MUNICIPAL FIRE REGULATIONS, DEPARTMENT, COMPANIES, AND RESCUE UNITS

The legislative authority of a municipal corporation may establish all necessary regulations to guard against the occurrence of fires, protect the property and lives of its citizens against damage and accidents resulting therefrom, and for such purpose may establish and maintain a fire department, provide for the establishment and organization of fire engine and hose companies and rescue units, establish the hours of labor of the members of its fire department who shall not be required to be on duty continuously more than six days in every seven, and provide such bylaws and regulations for the government of such companies and their members as is necessary and proper.

SECTION 737.23. SCHOOLING OF OFFICERS AND FIREMEN OF FIRE DEPARTMENT

The legislative authority of a municipal corporation may send any of the officers and firemen of its fire department to schools of instruction designed to promote the efficiency of firemen, and, if authorized in advance, may pay their necessary expenses from the funds used for the maintenance and operation of such department.

SECTION 2151.421. PHYSICIAN'S REPORT OF INJURY OR NEGLECT

Any physician, including a hospital intern or resident physician, whose examination of any child less than eighteen years of age discloses evidence of injury or physical neglect not explained by the available medical history as being accidental in nature, shall immediately report or cause reports to be made of such information to a municipal or county peace officer. Such reports shall be made forthwith by telephone or in person forthwith, and shall be followed by a written report, such report shall contain:

(A) The name and addresses of the child and his parents or person or persons having custody of such child, if known.

(B) The child's age and the nature and extent of the child's injuries or physical neglect, including any evidence of previous injuries or physical neglect.

(C) Any other information that the physician believes might be helpful in establishing the cause of the injury or physical neglect.

When the attendance of the physician is pursuant to the performance of services as a member of the staff of a hospital or similar institution, he shall notify the person in charge of the institution or his designated delegate who shall make the necessary reports.

Anyone participating in the making of such reports, or anyone participating in a judicial proceeding resulting from such reports, shall be immune from any civil or criminal liability that might otherwise be incurred or imposed as a result of such actions. Not withstanding Section 4731.22 of the Revised Code, the physician-patient privilege shall not be a ground for excluding evidence regarding a child's injuries or physical neglect, or the cause thereof in any judicial proceeding resulting from a report submitted pursuant to this section.

SECTION 2305.23. LIABILITY FOR EMERGENCY CARE

No person shall be liable in civil damages for administering emergency care or treatment at the scene of an emergency outside of a hospital, doctor's office, or other place having proper medical equipment, for acts performed at the scene of such emergency, unless such acts constitute willful or wanton misconduct.

Nothing in this section applies to the administering of such care or treatment where the same is rendered for remuneration or with the expectation of remuneration.

SECTION 2917.41. SUPPRESSION OF EVIDENCE WHEN BODY BEARS MARKS OF VIOLENCE

No person shall receive a human body having on it marks of violence, at a Medical College, Medical Society, School of Anatomy, or other place, without giving notice forthwith to the Coroner of the county wherein such body is then located. Whoever violates this section shall be fined not less than five hundred nor more than one thousand dollars and imprisoned not less than one nor more than ten years. The Coroner, upon receipt of such notice, shall hold an inquest.

SECTION 2923.08. MUTILATION OR DESTRUCTION OF DEAD HUMAN BODY

No person, not lawfully authorized to do so, shall mutilate or destroy any portion of a dead human body. Whoever violates this section shall be fined not more than ten thousand dollars or imprisoned not more than ten years.

SECTION 2923.43. RESTRICT AND CONTROL CROWDS

No person shall willfully obstruct, impede, or hamper in any way the lawful operations of sheriffs, policemen, or other law enforcement officers, or firemen, rescue personnel, medical personnel, or other authorized persons, at the scene of fires, accidents, disasters, or emergencies of any kind, and no person shall willfully fail to obey the lawful orders of sheriffs, policemen, or other law enforcement officers, engaged in the performance of their duties at the scene of or in connection with fires, accidents, disasters, or emergencies of any kind.

Whoever violates this section shall be fined not less than fifty nor more than five hundred dollars, or imprisoned in a county jail or workhouse not less than thirty days nor more than six months, or both. Nothing in this section shall be construed to limit access or deny information to any news media representatives in the lawful exercise of their duties.

SECTION 4511.01. DEFINITIONS

As used in sections 4511.01 to 4511. 80, inclusive, and 4511.99 of the Revised Code:

(D) "Emergency vehicle" means vehicles of salvage corporations organized under sections 1709.01 to 1709.07, inclusive, of the Revised Code, emergency vehicles of municipal or county departments of public utility corporations when identified as such as required by law, the director of highways, or local authorities, and motor vehicles when commandeered by a police officer.

(E) "Public safety vehicle" means ambulances, motor vehicles used by public law enforcement officers or other persons sworn to enforce the criminal and traffic laws of the state, and the vehicles used by fire departments, including motor vehicles when used by volunteer firemen responding to emergency calls in the fire department service when identified as required by the director of highway safety.

SECTION 4511.03. EMERGENCY AND PUBLIC SAFETY VEHICLES TO PROCEED CAUTIOUSLY PAST RED OR STOP SIGNAL

The driver of any emergency vehicle or public safety vehicle, when responding to an emergency call, upon approaching a red or stop signal or any stop sign shall slow down as necessary for safety to traffic, but may proceed cautiously past such red or stop sign or signal with due regard for the safety of all persons using the street or highway.

SECTION 4511.24. EMERGENCY AND PUBLIC SAFETY VEHICLES EXCEPTED FROM SPEED LIMITATIONS

The prima-facie speed limitations set forth in section 4511.21 of the Revised Code do not apply to emergency vehicles or public safety vehicles when they are responding to emergency calls, and when the drivers thereof sound audible signals by bell, siren, or exhaust whistle. This section does not relieve the driver of an emergency vehicle or public safety vehicle from the duty to drive with due regard for the safety of all persons using the street or highway.

SECTION 4511.45. PUBLIC SAFETY VEHICLES HAVE RIGHT OF WAY

Upon the approach of a public safety vehicle, equipped with at least one flashing, rotating or oscillating light visible under normal atmospheric conditions from a distance of five hundred feet to the front of such vehicle and the driver is given audible signal by siren, exhaust whistle, or bell, the driver of every other vehicle shall yield the right of way, immediately drive to a position parallel to, and as close as possible to, the right edge or curb of the highway clear of any intersection, and stop and remain in such position until the public safety vehicle has passed, except when otherwise directed by a police officer.

Upon the approach of a public safety vehicle, as stated in the first paragraph of this section, the operator of every streetcar or trackless trolley shall immediately stop such car clear of any intersection and keep it in such position until the public safety vehicle has passed, except when otherwise directed by a police officer.

This section does not relieve the driver of a public safety vehicle from the duty to drive with due regard for the safety of all persons and property upon the highway.

SECTION 4511.451. FUNERAL PROCESSION HAS RIGHT OF WAY

As used in this section "funeral procession" means two or more vehicles accompanying a body of a deceased person in the daytime when each of such vehicles has its headlights lighted and is displaying a purple and white pennant attached to each vehicle in such a manner as to be clearly visible to traffic approaching from any direction.

Excepting public safety vehicles proceeding in accordance with section 4511.45 of the Revised Code or when directed otherwise by a police officer, pedestrians and the operators of all vehicles, street cars, and trackless trolleys shall yield the right of way to each vehicle which is a part of a funeral procession. Whenever the lead vehicle in a funeral procession lawfully enters an intersection the remainder of the vehicles in such procession may continue to follow such lead vehicle through the intersection notwithstanding any traffic control devices or right of way provisions of the Revised Code, provided the operator of each vehicle exercises due care to avoid colliding with any other vehicle or pedestrian upon the roadway.

No person shall operate any vehicle as a part of a funeral procession without having the headlights of such vehicle lighted and without displaying a purple and white pennant in such a manner as to be clearly visible to traffic approaching from any direction.

SECTION 4511.72. FOLLOWING AN EMERGENCY VEHICLE OR PUBLIC SAFETY VEHICLE PROHIBITED

The driver of any vehicle, other than an emergency vehicle or public safety vehicle on official business, shall not follow any emergency vehicle or public safety vehicle traveling in response to an alarm closer than five hundred feet, or drive into or park such vehicle within the block where fire apparatus has stopped in answer to a fire alarm, unless directed to do so by a police officer or a fireman.

SECTION 4513.21. HORNS, SIRENS, AND WARNING DEVICES

Every motor vehicle or trackless trolley when operated upon a highway shall be equipped with a horn which is in good working order and capable of emitting a distance of not less than two hundred feet.

No motor vehicle or trackless trolley shall be equipped with, nor shall any person use upon a vehicle, any siren, whistle, or bell. Any vehicle may be equipped with a theft alarm signal device which shall be so arranged that it cannot be used as an ordinary warning signal. Every emergency vehicle shall be equipped with a siren, whistle, or bell, capable of emitting sound audible under normal conditions from a distance of not less than five hundred feet and of a type approved by the director of highways. Such equipment shall not be used except when such vehicle is operated in response to an emergency call or is in the immediate pursuit of an actual (or) suspected violator of the law, in which case the driver of the emergency vehicle shall sound such equipment when it is necessary to warn pedestrians and other drivers of the approach thereof.

SECTION 5739.02. EXEMPT SALES TO VOLUNTEER FIRE DEPARTMENTS FROM THE SALES TAX

(23) Sales of emergency and fire protection vehicles and equipment to not for profit organizations for use solely in providing fire protection and emergency services for political subdivisions of the state.

APPENDIX I

PROPHYLAXIS AGAINST TETANUS

Wesley Furste, M.D., F.A.C.S.*

During the past few years, the Weekly Reports from the U.S.P.H.S. National Communicable Disease Center in Atlanta, Georgia, emphasize that, with proper prophylaxis, tetanus is being diagnosed less frequently in the United States. According to the December 27, 1969, Weekly Report, for the first 52 weeks of the year during the period 1964-1968, there was reported an average of 233 cases of tetanus for the entire United States; for the first 52 weeks of 1968, there was reported 163 cases; and, for the first 52 weeks of 1969, there was reported 166 cases.

Such encouraging figures should not, however, lessen the continuing efforts of physicians and allied medical personnel to eliminate tetanus and to make it a disease of only historical significance. Since the Clostridium tetani is ubiquitous and since wounds are constantly occurring, superior tetanus prophylaxis must continue at all times.

Observing the following recommendations will eliminate tetanus and the reactions associated with certain drugs used for tetanus prophylaxis (1).

I. Guide Lines in the Prevention of Tetanus

A. Individualization: The need for and method of prophylaxis against tetanus must be determined for each patient with a wound according to individual indications.

B. Tetanus Toxoid

1. Tetanus may be prevented by universal active immunization with tetanus toxoid and routine booster injections of toxoid every 6 to 10 years supplemented by a wound booster.

2. Every patient with a wound should receive an injection of tetanus toxoid (see 3. below for exception).

a. To those already actively immunized, this becomes a wound booster.

b. For those not immunized, this becomes the first in a series for active immunization.

---

*Clinical Associate Professor of Surgery, College of Medicine, Ohio State University; Columbus, Ohio

3. A wound booster may be omitted safely in individuals who are definitely known to have been actively immunized in the past and to have had a booster within the previous 12 months.

4. A number of investigators have shown an unexpectedly high incidence of long lasting immunity with tetanus toxoid.

a. In their studies, 85% to 95% of individuals immunized against tetanus during World War II still carried protective antibody levels 15 to 21 years later.

b. Furthermore, with practically no exceptions, these individuals responded well to a booster dose of toxoid.

c. The unusual possibility of failure to respond to toxoid could be due to agammaglobulinemia or to recent exposure to radiation.

5. Routine use of precipitated or milky toxoid appears advisable for basic immunization and booster injections.

a. The term precipitated toxoid includes these preparations: tetanus toxoid alum precipitated, tetanus toxoid aluminum hydroxide absorbed, tetanus toxoid aluminum hydroxide precipitated, tetanus toxoid aluminum phosphate absorbed, and tetanus toxoid aluminum phosphate precipitated.

b. Fluid toxoid may be used as a booster injection when precipitated toxoid is not available.

6. The production of tetanus toxin within the tissues in a wound in an actively immunized person probably stimulates a rise in titer of antibodies.

a. Since the rise is not rapid enough to provide protection, routine booster injections every 6 to 10 years and a wound booster when indicated are advised.

C. Surgical care. Immediate, meticulous cleansing and debridement of wounds, at times with the wound left open, are most important for proper prophylaxis against tetanus.

D. Antitoxin

1. Tetanus immune globulin (human), which is human tetanus antitoxin and which is referred to by the term TIG(H), is an effective homologous antitoxin for passive immunization against tetanus.

a. Because it offers distinct advantages, it should be used in preference to the heterologous equine and bovine antitoxins when it is available.

b. The availability of TIG(H) in no way reduces the need for active immunization, which remains preferable to all forms of passive immunization.

2. The skin and eye tests for sensitivity to horse serum and a carefully taken history of possible allergic manifestations are a medical responsibility.

a. Before giving equine or bovine tetanus antitoxin to a patient, the physician must determine whether the danger of tetanus exceeds the danger of anaphylaxis.

b. The patient who has had horse serum previously may neutralize a new injection rapidly, even without a positive skin or eye test.

c. The patient sensitive to horse serum is extremely likely to neutralize it rapidly.

d. A patient who has not received an injection of horse serum previously may be sensitive to it.

E. Antibiotics

1. Penicillin and oxytetracycline administered immediately after injury are possibly deterrents against tetanus infection.

2. Antibiotics should not be regarded as a substitute for active or passive immunization or for superior wound care.

F. At the time of initial immunization, the patient--or if he is an infant or child, his parent--is given a filled-out emergency medical identification device.

1. He is instructed to carry it with him at all times.

2. Pertinent data are recorded on the device at each immunization.

G. General Principles

1. Tetanus is a toxemia and not an invasive infection.

2. In the great majority of instances, local signs of tetanus precede systemic signs.

a. Consequently, every patient with a severe wound, whether he is immunized passively or actively, should be watched closely for several weeks.

3. The Board of Regents and the Committee on Trauma of the American College of Surgeons recommend that mass immunization with tetanus toxoid be a part of every program for civil defense.

II. Basic Immunization and Periodic Immunization for the Non-Wounded

A. Children older than 6 years and adults are given basic immunization by administration of 3 doses of precipitated toxoid intramuscularly.

1. The second dose is given 1 month after the first; the third dose, 12 months later.

2. Periodic booster doses are then given at intervals of 6 to 10 years.

B. Infants and children through 6 years of age receive tetanus toxoid in combination with diphtheria toxoid and pertussis vaccine.

1. This is given at monthly intervals for 3 doses, with a fourth dose 1 year later to complete the basic immunization.

2. Doses are also given just prior to entrance to kindergarten or elementary school, to the sixth grade, and to the twelfth grade.

C. The occupations or activities of some people make them likely to incur tetanus-prone wounds including some that may go unrecognized.

1. The physician should regard these patients as in particular need of a high level of actively produced immunity with toxoid for the control of unrecognized contamination of minor wounds.

2. Three doses of toxoid in the primary immunization schedule and periodic booster doses at intervals of 6 years will provide the necessary protection.

III. Prophylaxis Against Tetanus in Wound Management

A. Patients actively immunized with toxoid

1. To patients who have had their basic immunization or a booster dose of tetanus toxoid within 6 years, give 0.5 ml. of precipitated toxoid intramuscularly. (For exception, see IB3.)

2. For patients who have had basic immunization but have not had a booster dose within 6 years of the time of injury, a booster dose of toxoid is usually all that is required.

a. When the character of the wound indicates an overwhelming possibility of tetanus infection, however, passive immunization also may be provided, preferably with tetanus immune globulin (human).

b. The TIG(H) is given in one gluteal muscle while, with a separate syringe and needle, 0.5 ml. of precipitated tetanus toxoid is given in the contralateral deltoid muscle as a wound booster.

c. In general, a wound with an overwhelming possibility of infection has penetrated deeply into the tissues, is anaerobic, is extensive, is grossly contaminated, contains much severely injured tissue, and is more than 24 hours old.

B. Patients not previously immunized with toxoid

1. In patients with clean minor wounds for which passive immunization is not necessary, active immunization with precipitated toxoid should be initiated.

a. The opportunity to start active immunization should not be wasted.

2. In patients who have never been immunized with toxoid but in whom the character of the wound indicates the need for tetanus prophylaxis, passive immunization must be provided.

a. TIG(H) in a dosage of 250 to 500 units is preferred with 500 units being primarily reserved for the wound more than 24 hours old.

b. If this drug is not available, 3000 units of equine or, in some instances, bovine tetanus antitoxin are given.

c. At the same time, active immunity is initiated against tetanus by giving, with a separate syringe and needle, 0.5 ml. precipitated tetanus toxoid in one deltoid muscle; and, for passive immunization, TIG(H) is administered in a contralateral gluteal muscle.

d. The patient is urged to complete the series of toxoid injections in order to develop active immunization.

3. In urgent cases when TIG(H) and heterologous antitoxins are not available, consideration should be given to the use of transfused blood from a known immune donor who has received a booster dose of tetanus toxoid one month previously.

a. Of course, adequate debridement of the wounds should be done.

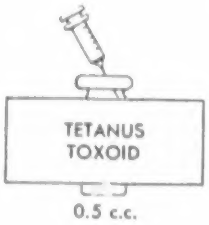
1) Under such circumstances, definite consideration should be given to not closing the wounds.

b. In addition, 1.2 million units of long-acting benzathine penicillin G intramuscularly or oxytetracycline by the oral dosage of 1 to 2 Gm. daily for one to three weeks may be administered.

Specific Measures

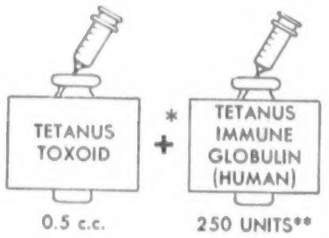
Previously Immunized Individuals

A. When the *patient has been immunized within the past six years,* give 0.5 c.c. tetanus toxoid booster.


TETANUS
TOXOID
0.5 c.c.

B. When the *patient has been immunized more than six years,*

1. To the great majority only give 0.5 c.c. of tetanus toxoid.
2. To those with wounds which indicate an overwhelming possibility that tetanus will develop,
   a) Give* 0.5 c.c. of tetanus toxoid,
   b) Give* 250 units of human tetanus immune globulin,**
   c) Consider use of oxytetracycline or penicillin.

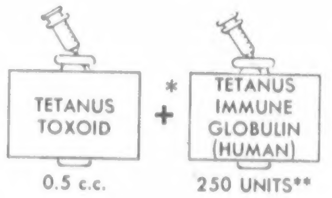

TETANUS
TOXOID
0.5 c.c.
*
+
TETANUS
IMMUNE
GLOBULIN
(HUMAN)
250 UNITS**

Individuals NOT Previously Immunized

A. For *clean minor wounds* in which tetanus is unlikely, give 0.5 c.c. of tetanus toxoid (initial immunizing dose).

TETANUS
TOXOID
0.5 c.c.

B. For *all other wounds*
1. Give* 0.5 c.c. of tetanus toxoid (initial immunizing dose),
2. Give* 250 units of human tetanus immune globulin,**
3. Consider use of oxytetracycline or penicillin.

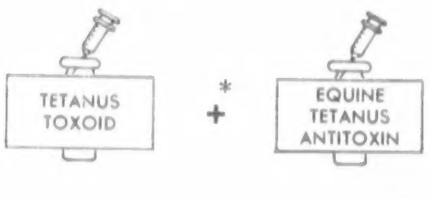

TETANUS
TOXOID
0.5 c.c.
*
+
TETANUS
IMMUNE
GLOBULIN
(HUMAN)
250 UNITS**

C. *Equine antitoxin* is to be used only if human tetanus immune globulin is not available within 24 hours and only if the possibility of tetanus outweighs the danger of reaction to equine tetanus antitoxin. First, question patient and test for sensitivity.

*Use different syringes, needles, and sites of injection.

**In severe, neglected or old wounds, 500 units of human tetanus immune globulin are advisable.

If patient is not sensitive to equine tetanus antitoxin, give at least 3,000 units.


TETANUS
TOXOID
*
+
EQUINE
TETANUS
ANTITOXIN

If patient is sensitive to equine tetanus antitoxin by history or test, give penicillin or oxytetracycline, not antitoxin. Danger of anaphylaxis probably outweighs danger of tetanus. Do not attempt desensitization.

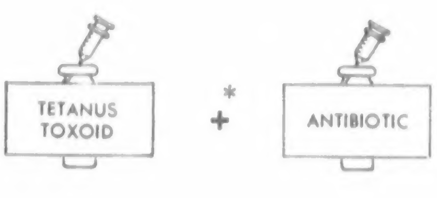

TETANUS
TOXOID
*
+
ANTIBIOTIC

TABLE 1. Outline of specific measures for prophylaxis against tetanus in wound management (2).

REFERENCES

1. Furste, W. August 1969. Current Status of Tetanus Prophylaxis. Ind. Med. & Surg. 38, no. 8: 41-51.

2. Furste, W., Skudder, P.A., and Hampton, O.P., Jr. Sept.-Oct. 1967. Prophylaxis Against Tetanus in Wound Management. Bull. Amer. Coll. Surg. 52: 230.

APPENDIX II

CARDIAC MONITORING AND TELEMETRY

(NOTE: The following information is included in this text only to present the advances in the development of devices for monitoring and telemetry and the anticipated function of emergency medical personnel.)

Heart attacks and other coronary diseases claim the lives of over half a million people a year and can be classified as the number one killer in the United States.

The majority of those stricken are outside the reach of immediate medical care, and until recently little was known about the facts surrounding the circumstances that caused sudden death.

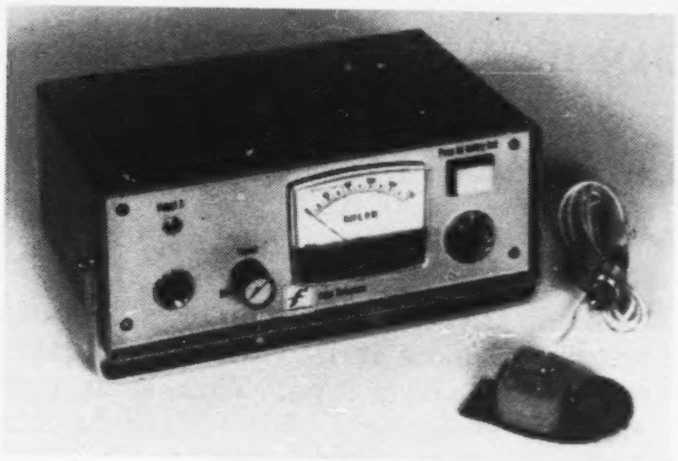
Since the inception of the mobile coronary care unit, statistics have been compiled and documented indicating a definite advantage in providing this sophisticated care at the scene.

The mobile coronary care unit can transport the complete facility to the victim wherever he is, providing him with on-the-spot care equivalent to that of the hospital.

The mobile coronary care unit must have the capability of transmitting a victim's electrocardiograph from where he lies, through the vehicle, and to the hospital where it is visually displayed and printed on a tape. This, then, permits an evaluation of the victim's condition by the medical staff in the hospital, and, via a two-way radio, communicate directly to the emergency personnel at the scene, thus making available to the victim the resource of medical knowledge wherever he may be.

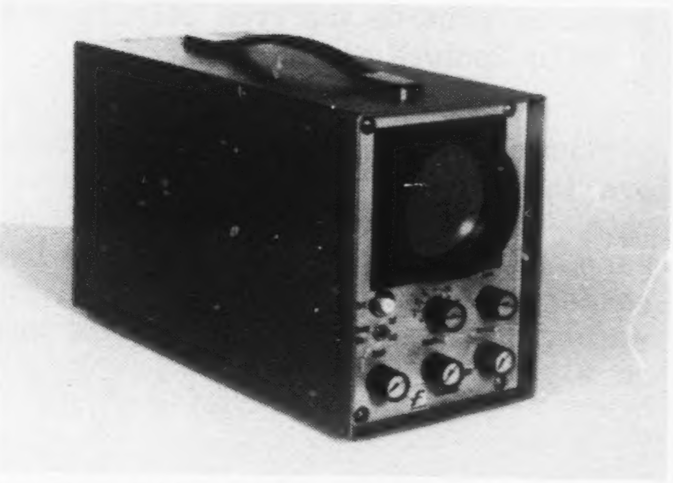
Recent studies have revealed that a large number of cardiac victims who die do so before reaching the hospital. The greatest single cause of death in these emergencies is due to arrhythmias (e.g. ventricular fibrillation). As a result, much emphasis is now being placed on the need for extending the emergency room type services to the victim at the emergency site. Properly trained emergency medical personnel are now and will be used more and more to provide the type of care now given by doctors and nurses.

Shown in the following photographs are instruments for monitoring pulse rate, electrocardiograph, blood pressure, a defibrillator, an ECG chart recorder, and other equipment used for evaluating vital signs and life-support care.



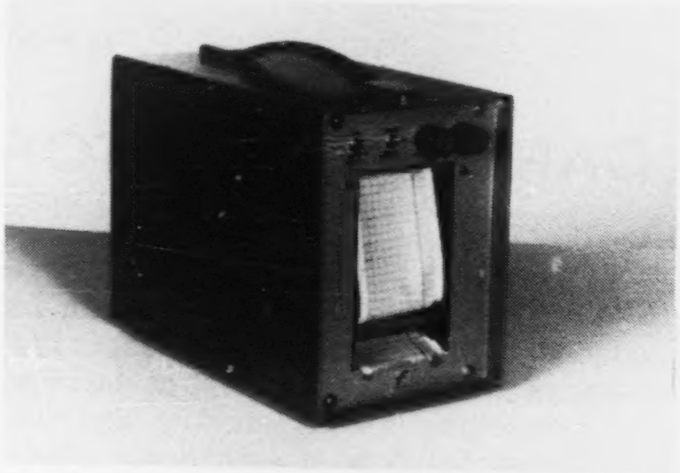
Courtesy of Fairfield Surgical and Medical-Electronics, Inc.

FIGURE 1. Pulse tachometer. The pulse is detected by a sensitive photoelectric pick up. A light on the front gives a distinct flash with each pulse beat, and a loud-speaker with volume control sounds an audible tone. The meter continuously shows pulses per minute on a linear scale. The pulse can be picked up from a finger, forehead, or any other location with good blood circulation.



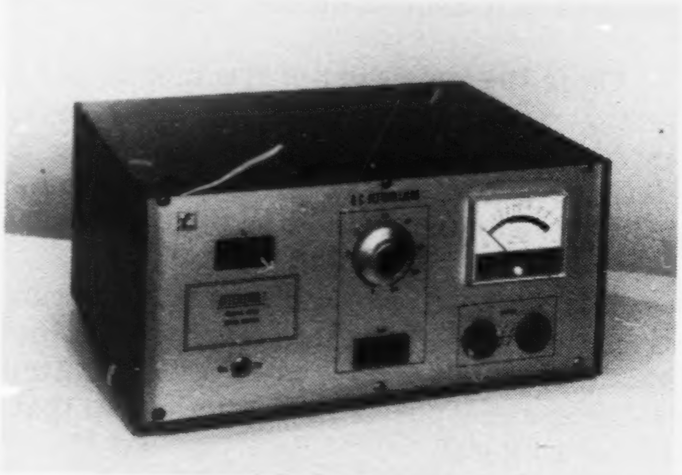
Courtesy of Fairfield Surgical and Medical-Electronics, Inc.

FIGURE 2. Cardioscope. A portable all-purpose unit that will operate on battery or AC current.



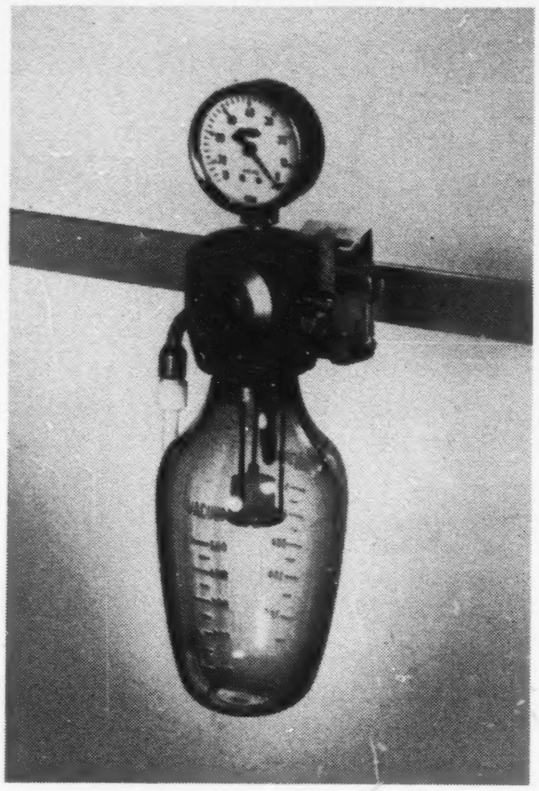
Courtesy of Fairfield Surgical and Medical-Electronics, Inc.

FIGURE 3. Chart recorder. The chart recorder will provide a continuous print-out of the victim's ECG.



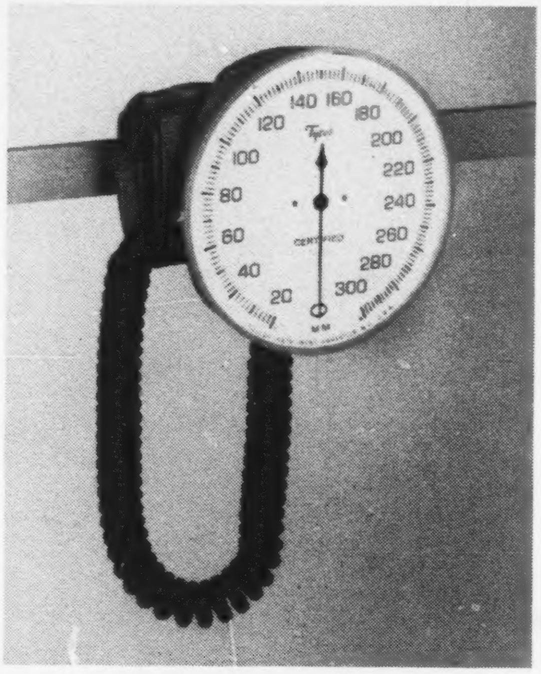
Courtesy of Fairfield Surgical and Medical-Electronics, Inc.

FIGURE 4. D. C. Defibrillator. This device is used to correct ventricular fibrillation and its use requires specialized training by a cardiologist. It has a maximum output of approximately 7000 volts which certainly dictates the need for safe operating procedures.



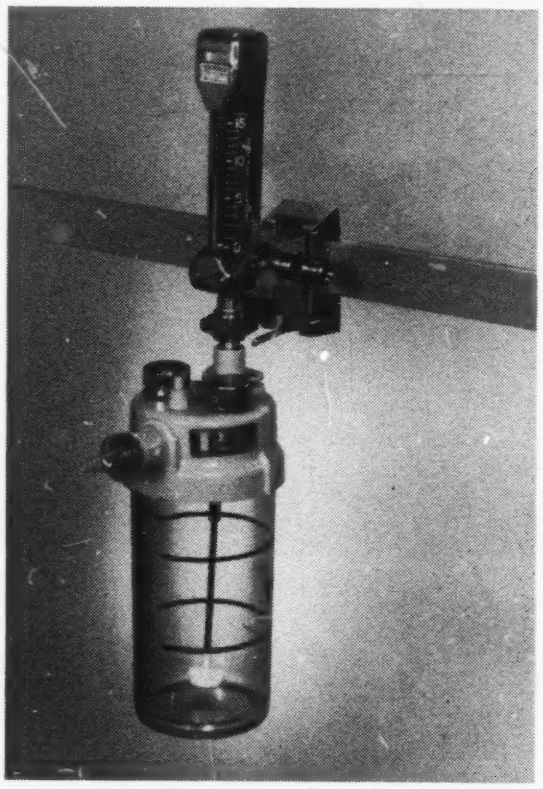
Courtesy of Fairfield Surgical and Medical-Electronics, Inc.

FIGURE 5. Suction unit



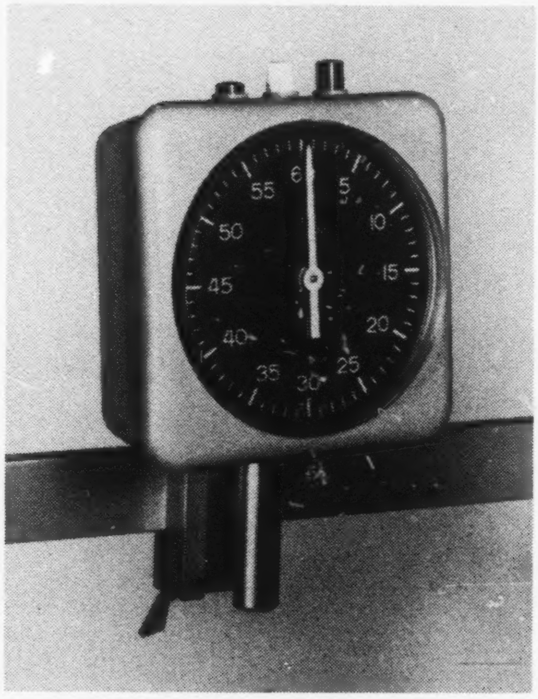
Courtesy of Fairfield Surgical and Medical-Electronics, Inc.

FIGURE 7. Sphygmomanometer (for taking blood pressure). This unit has a large dial for easy reading within the vehicle.



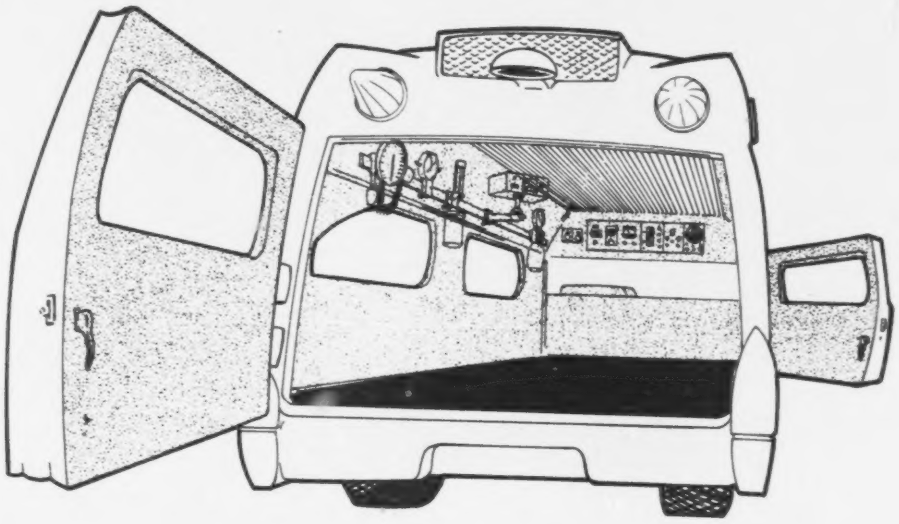
Courtesy of Fairfield Surgical and Medical-Electronics, Inc.

FIGURE 6. Oxygen flow-meter with humidifier.



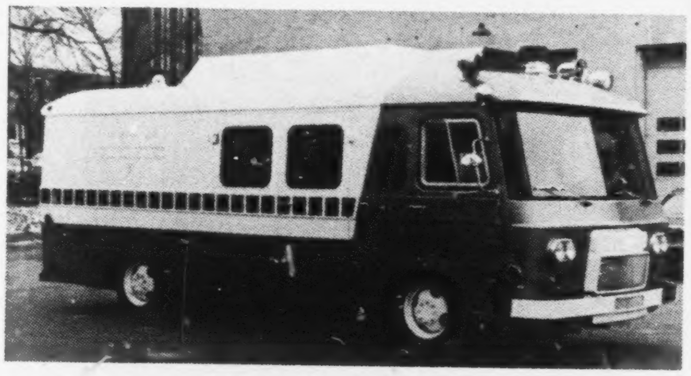
Courtesy of Fairfield Surgical and Medical-Electronics, Inc.

FIGURE 8. Stop clock and timer. The large dial with a sweep-second hand is easy to read and permits time keeping of absence of breathing, labor pains, interval and duration of epileptic seizures, etc.



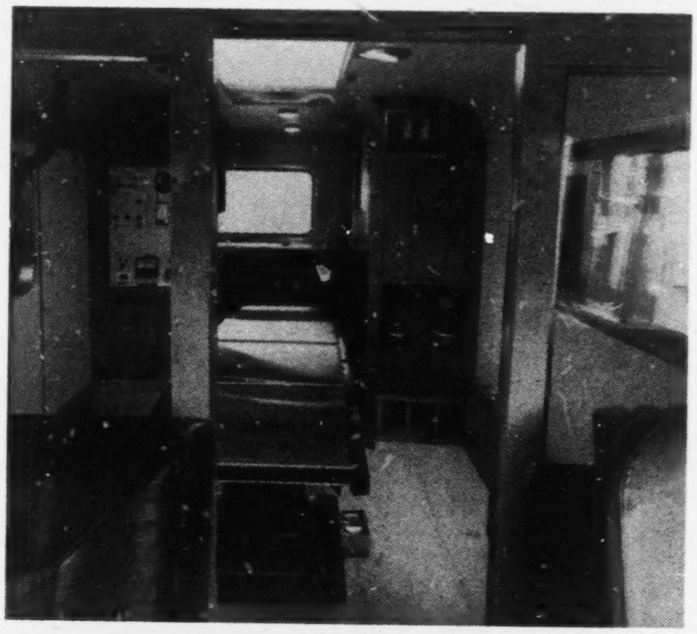
Courtesy of Fairfield Surgical and Medical-Electronics, Inc.

FIGURE 9. Shown is an emergency ambulance fully equipped and utilizing the rail concept of equipment installation. Rails fastened horizontally to walls, plus movable guides, are the basic parts of this system. Equipment attached can be quickly moved or changed to permit efficient use near the victim.



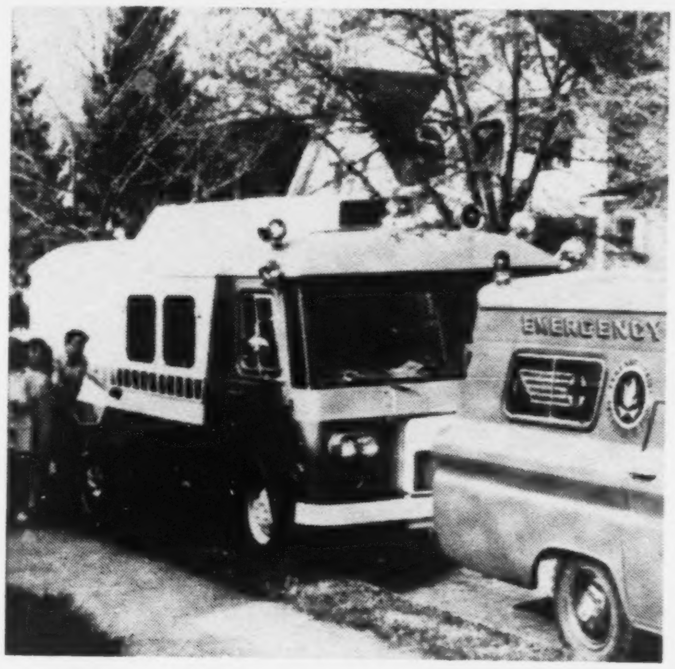
Courtesy Dave Ellies Industrial Design, Inc.

FIGURE 10. The "Heartmobile," the first vehicle of its kind in the United States, and one of the most sophisticated in the world in service at The Ohio State University Hospital.



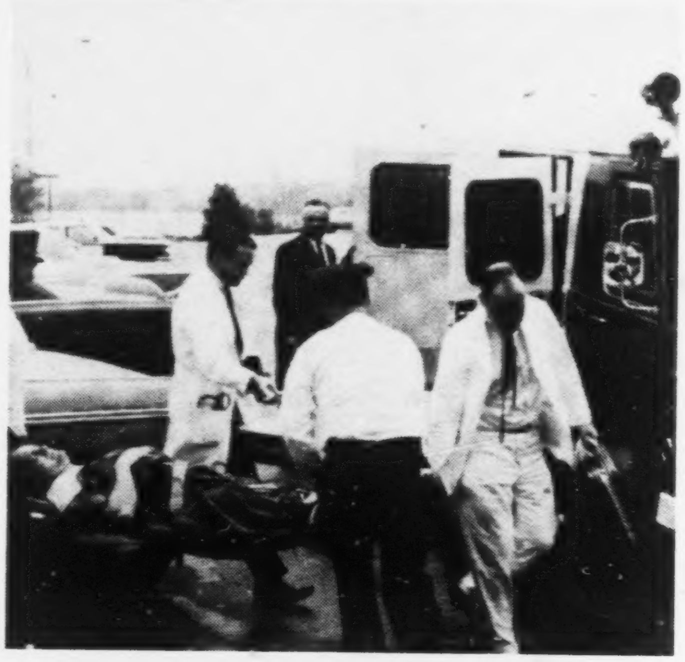
Courtesy Dave Ellies Industrial Design, Inc.

FIGURE 11. Interior of the "Heartmobile". The panel at the left contains the built-in monitoring and telemetering equipment. The cabinets at the right contain all necessary drugs, oxygen, and suction equipment.



Courtesy Dave Ellies Industrial Design, Inc.

FIGURE 12. The "Heartmobile" shown working in concert with the emergency squad on a "heart" run.



Courtesy Dave Ellies Industrial Design, Inc.

FIGURE 13. The victim completely evaluated and stabilized is moved to the "Heartmobile" for transport to the hospital. Monitoring continues.

GLOSSARY OF TERMS

abdomen—(ab-do'men) body area between the diaphragm and pelvis.

absorption—(ab-sorp'shen) passage of a substance through a membrane (for example, skin or mucosa) into blood.

Achilles tendon—(A-kil'ez ten'don) tendon inserted on calcaneus; so-called because of the Greek myth that Achilles' mother held him by the heels when she dipped him in the river Styx, thereby making him invulnerable except in this area.

acidosis—(as'i-do'sis) condition in which there is an excessive proportion of acid in the blood.

adduct—(a-dukt') to move toward the midline; opposite of abduct.

adenoid—(ad'n-oid') literally, glandlike; adenoids or pharyngeal tonsils are paired lymphoid structures in the nasopharynx.

adrenalin—(ad-ren'al-in) one of the secretions of two small glands, called adrenal glands, located just above the kidneys. This secretion, also called spinephrine, and sometimes prepared synthetically, constricts the small blood vessels (arterioles), increases the rate of heart beat, and raises blood pressure. It is called a vasoconstrictor or vasopressor substance.

albuminuria—(al-bu'min-nyoor'i-a) albumin in the urine.

alkalosis—(al'ka-lo'sis) condition in which there is an excessive proportion of alkali in the blood; opposite of acidosis.

alveolus—(al-ve'a-les) literally a small cavity; alveoli of lungs are microscopic saclike dilations of terminal bronchioles.

amino acid—(a-mi'no as'id) amino acids are the structural units from which proteins are built.

anemia—(a-ne'mi-a) deficient number of red blood cells or deficient hemoglobin.

anesthesia—(an-es-the'zha) loss of sensation.

aneurysm—(an'u-rizm) a spindle-shaped or saclike bulging of the wall of a vein or artery, due to weakening of the wall by disease or an abnormality present at birth.

angina—(an'ji-na) any disease characterized by spasmodic suffocative attacks; for example, angina pectoris and paroxysmal thoracic pain with feeling of suffocation.

angina pectoris—(an'ji-na pek'to-ris) literally means chest pain. A condition in which the heart muscle receives an insufficient blood supply, causing pain in the chest, and often in the left arm and shoulder. Commonly results when the arteries supplying the heart muscle (coronaries) are narrowed by atherosclerosis.

angiocardiography—(an'je-o-kar-de-og'rah-fe) X-ray examination of the heart and great blood vessels that follows the course of an opaque fluid which has been injected into the blood stream.

ankylosis—(an'ke-lo'sis) abnormal immobility of a joint.

anorexia—(an-o-rek'se-ah) lack or loss of appetite for food.

anoxia—(an-ok'se-ah) literally, no oxygen. This condition most frequently occurs when the blood supply to a part of the body is completely cut off. This results in the death of the affected tissue. For example, a specific area of the heart muscle may die when the blood supply (and hence the oxygen supply) has been blocked, as by a clot in the artery supplying that area.

antagonistic muscles—(an-tag'e-nis'tik mus'l) those having opposing actions; for example, muscles that flex the upper arm are antagonists to muscles that extend it.

anterior—(an-ter'i-er) front or ventral; opposite of posterior or dorsal.

antibody, immune body—(an'ti-bod'i, i-mun' bodi) substance produced by the body that destroys or inactivates a specific substance (antigen) that has entered the body; for example, diphtheria antitoxin is the antibody against diphtheria toxin.

anticoagulant–(an'te-ko-ag'u-lant) a drug which delays clotting of the blood. When given in cases of a blood vessel plugged up by a clot, it tends to prevent new clots from forming, or the existing clots from enlarging, but does not dissolve an existing clot. Examples are heparin and coumarin derivatives.

antihypertensive agents–(an'te-hi-per-ten'siv) drugs which are used to lower blood pressure such as ruawolfia, reserpine, veratrum, hydralazine, hexamethonium chloride, and many others.

antiseptic–(an'ti-sep'tik) preventing bacterial growth and multiplication.

antrum–(an'trem) cavity; for example, the antrum of Highmore, the space in each maxillary bone, or the maxillary sinus.

anus–(a'nes) distal end or outlet of the rectum.

anxiety–(ang-zi'e-te) a feeling of apprehension, the source of which is unrecognized.

aorta–(a-or'tah) the main trunk artery which receives blood from the lower left chamber of the heart. It originates from the base of the heart, arches up over the heart like a cane handle, and passes down through the chest and abdomen in front of the spine. It gives off many lesser arteries which conduct blood to all parts of the body except the lungs.

aortic arch–(a-or'tik) the part of the aorta or large artery leaving the hear, which curves up like the handle of a cane over the top of the heart.

aortic insufficiency–(a-or'tik) an improper closing of the valve between the aorta and the lower left chamber of the heart admitting a back flow of blood.

aortic valve–(a-or'tik) valve at the junction of the aorta, or large artery, and the lower left chamber of the heart. Formed by three cup-shaped membranes called semilunar valves, it allows the blood to flow from the heart into the artery and prevents a back flow.

aortography–(a-or-tog'rah-fe) X-ray examination of the aorta (main artery conducting blood from the lower left chamber of the heart to the body) and its main branches. This is made possible by the injection of a dye which is opaque to X-rays.

apex–(a'peks) the blunt rounded end of the heart, directed downward, forward, and to the left.

apoplexy–(ap'o-plek-se) frequently called apoplectic stroke or simply a stroke. A sudden interruption of the blood supply to a part of the brain caused by the obstruction or rupture of an artery. Initially may be manifested by a loss of consciousness, sensation, or voluntary motion, and may leave a part of the body (frequently one side) temporarily or permanently paralyzed.

arrhythmia–(ah-rith'me-ah) an abnormal rhythm of the heart beat.

arterial blood–(ar-te're'al) oxygenated blood. The blood is oxygenated in the lungs, passes from the lungs to the left side of the heart via the pulmonary veins. It is then pumped by the left side of the heart into the arteries which carry it to all parts of the body.

arterioles–(ar-te're-ols) the smallest arterial vessels (about 0.2 mm. or 1/125 inch in diameter) resulting from repeated branching of the arteries. They conduct the blood from the arteries to the capillaries.

arteriosclerosis–(ar-te're-o-skle-ro'sis) commonly called hardening of the arteries. This is a generic term which includes a variety of conditions which cause the artery walls to become thick and hard and lose elasticity.

artery–(ar'ter-e) blood vessels which carry blood away from the heart to the various parts of the body. They usually carry oxygenated blood except for the pulmonary artery which carries unoxygenated blood from the heart to the lungs for oxygenation.

arthrosis–(ar-thro'sis) joint or articulation.

articulation–(ar-tik'yoo-la'shen) joint.

asphyxia–(as-fik'si-a) loss of consciousness due to deficient oxygen supply.

aspirate–(as'pe-rat') to remove by suction.

ataxia–(a-tak'si-a) loss of power of muscle coordination.

atherosclerosis–(ath'er-o-skle-ro'sis) a kind of arteriosclerosis in which the inner layer of the artery wall is made thick and irregular by deposits of a fatty substance. These deposits (called atheromata) project above the surface of the inner layer of the artery, and thus decrease the diameter of the internal channel of the vessel.

atrio-ventricular node–(a'tre-o-ven-trik'u-lar) a small mass of special muscular fibers at the base of the wall between the two upper chambers of the heart. It forms the beginning of the Bundle of His which is the only known direct muscular connection between the upper and the lower chambers of the heart. The electrical impulses controlling the rhythm of the heart are generated by the pacemaker, conducted through the muscle fibers of the right upper chamber of the heart to the atrio-ventricular node, and then conducted to the lower chambers of the heart by the Bundle of His.

atrio-ventricular valves–(a'tre-o-ven-trik'u-lar) the two valves, one in each side of the heart, between the upper and lower chamber. The one in the right side of the heart is called the tricuspid valve, and the one in the left side is called the mitral valve.

atrium–(a'tre-um) one of the two upper chambers of the heart. Also called auricle, although this is now generally used to describe only the very tip of the atrium. Right atrium receives un-oxygenated blood from the body. Left atrium receives oxygenated blood from lungs. Capacity in adult about 57 cc.

atrophy–(at're-fi) wasting away of tissue; decrease in size of a part.

auricle–(aw're-kl) the upper chamber in each side of the heart. "Atrium" is another term commonly used for this chamber.

auscultation–(aws-kul-ta'shun) the act of listening to sounds within the body, usually with a stethoscope.

autonomic–(o'te-nom'ik) self-governing; independent.

autonomic nervous system–(aw-to-nom'ik) sometimes called involuntary nervous system, it controls tissues not under voluntary control, e.g., glands, heart, and smooth muscles.

axilla–(ak-sil'a) armpit.

barbiturate–(bar-bit'u-rat) a class of drugs which produces a calming effect. A sedative.

benzothiadiazine–(ben-zo-thi-ah-di'ah-zin) a drug used to increase the output of urine by the kidney. A diuretic.

biceps–(bi'seps) two headed.

Bicuspid valve–(bi-kus'pid) usually called mitral valve. A valve of two cusps or triangular segments, located between the upper and lower chamber in the left side of the heart.

blood pressure–the pressure of the blood in the arteries.

1. Systolic blood pressure–blood pressure when the heart muscle is contracted (systole).
2. Diastolic blood pressure–blood pressure when the heart muscle is relaxed between beats (diastole).

Blood pressure is generally expressed by two numbers, as 120/80, the first representing the systolic, and the second, the diastolic pressure.

blue babies–babies having a blueness of skin (cyanosis) caused by insufficient oxygen in the arterial blood. This often indicates a heart defect, but may have other causes such as premature birth or impaired respiration.

bradycardia–(brad-e-kar'de-ah) abnormally slow heart rate. Generally, anything below 60 beats per minute is considered bradycardia.

bromide–(bro'mid) any one of several drugs which produces a calming effect. A sedative.

bronchiole–(bron'ki-ol') small branch of a bronchus.

bronchus–(bron'kes) one of the two branches of the trachea.

buccal–(buk'l) pertaining to the cheek.

Bundle of His–(hiss) also called auriculo-ventricular bundle, atrio-ventricular bundle, or A-V bundle. A bundle of specialized muscle fibers running from a small mass of muscular fibers (atrio-ventricular node) between the upper chambers of the heart, down to the lower chambers. It is the only known direct muscular connection between the upper and lower heart chambers, and serves to conduct impulses for the rhythmic heart beat from the atrio-ventricular node to the heart muscle. Named after Wilhelm His, German anatomist.

buttock–(but'ek) prominence over the gluteal muscles.

calculus–(kal'kyoo-les) stone; formed in various parts of the body; may consist of different substances.

calorie–(kal'o-re) sometimes called large or kilocalories. Unit used to express food energy. The amount of heat required to raise the temperature of 1 kilogram of water 1 degree Centigrade. A high calorie diet has a prescribed calorie value above the total daily energy requirement. A low calorie diet has a prescribed calorie value below the total energy requirement.

calyx–(ka'liks) cup-shaped division of the renal pelvis.

capillaries–(kap'i-lar-ez) extremely narrow tubes forming a network between the arterioles and the veins. The walls are composed of a single layer of cells through which oxygen and nutritive materials pass out of the tissues, and carbon dioxide and waste products are admitted from the tissues into the blood stream.

carbohydrate–(kar'be-hi'drat) organic compounds containing carbon, hydrogen, and oxygen in certain specific proportions; for example, sugars, starches, and cellulose.

carcinoma–(kar'se-no'ma) cancer, a malignant tumor.

cardiac–(kar'de-ak) pertaining to the heart. Sometimes refers to a person who has heart disease.

cardiac cycle–(kar'de-ak) one total heart beat, i.e., one complete contraction and relaxation of the heart. In man, this normally occupies about 0.85 second.

cardiac output–(kar'de-ak) the amount of blood pumped by the heart per minute.

cardiovascular–(kar'de-o vas'ku-lar) pertaining to the heart and blood vessels.

cardiovascular-renal disease–(kar'de-o-vas'ku-lar re'-nal) disease involving the heart, blood vessels, and kidneys.

carditis–(kar-di'tis) inflammation of the heart.

caries–(kar'ez) decay of teeth or of bone.

carotid–(kah-rot'id) from Greek word meaning to plunge into deep sleep; carotid arteries of the neck so called because pressure on them may produce unconsciousness.

carotid arteries–(kah-rot'id) the left and right common carotid arteries are the principal arteries supplying the head and neck. Each has two main branches, external carotid artery and internal carotid artery.

carpal–(kar'p'l) pertaining to the wrist.

catabolism–(ka-tab'e-liz'm) breakdown of food compounds or of protoplasm into simpler compounds; opposite of anabolism, the other phase of metabolism.

catalyst–(kat'l-ist) substance which accelerates the rate of a chemical reaction.

cataract–(kat'a-rakt') opacity of the lens of the eye.

catheterization–(kath'e-ter-i-za'shun) in cardiology, the process of examining the heart by means of introducing a thin tube (catheter) into a vein or artery and passing it into the heart.

cecum–(se'kum) blind pouch; the pouch at the proximal end of the large intestine.

celiac–(se'le-ak) pertaining to the abdomen.

cellulose–(sel'u-los) polysaccharide, the main plant carbohydrate.

centimeter–(sen'ti-me'ter) 1/100 of a meter, about 2/5 of an inch.

cerebral vascular accident–(ser'e-bral vas'ku-lar) sometimes called cerebrovascular accident, apoplectic stroke, or simply stroke. An impeded blood supply to some part of the brain, generally caused by one of the following four conditions:

1. a blood clot forming in the vessel (cerebral thrombosis).
2. a rupture of the blood vessel wall (cerebral hemorrhage).
3. a piece of clot or other material from another part of the vascular system which flows to the brain and obstructs a cerebral vessel (cerebral embolism).
4. pressure on a blood vessel as by a tumor.

cerebrovascular–(ser'e-bro-vas'ku-lar) pertaining to the blood vessels in the brain.

cervix–(ser'viks) neck; any neckline structure.

chemotherapy–(ke-mo-ther'ah-pe) the treatment of disease by administering chemicals. Frequently used in the phrase "chemotherapy of hypertension," i.e., the treatment of high blood pressure by the use of drugs.

chloral hydrate–(klo'ral hi'drat) a drug, which has a calming action, used to induce sleep. A sedative.

cholecystectomy–(ko-le-sis-tek'to-me) removal of the gallbladder.

cholesterol–(ko-les'ter-ol) a fat-like substance found in animal tissue. In blood tests the normal level for Americans is assumed to be between 180 and 230 milligrams per 100 cc. A higher level is often associated with high risk or coronary atherosclerosis.

chordae tendineae–(kor'di ten-din'e-i) fibrous chords which serve as guy ropes to hold the valves between the upper and lower chambers of the heart secure when forced closed by pressure of blood in the lower chambers. They stretch from the cusps of the valves to muscles called papillary muscles in the walls of the lower heart chambers.

chorea–(ko-re'ah) involuntary, irregular twitching of the muscles sometimes associated with rheumatic fever. Also called St. Vitus Dance, or Sydenham's Chorea.

cilia–(sil'e-ah) hairlike projections of protoplasm.

circulatory–(ser'ku-lah-to-re) pertaining to the heart, blood vessels, and the circulation of the blood.

claudication–(klaw-de-ka'shun) pain and lameness or limping caused by defective circulation of the blood in the vessels of the limbs.

clubbed fingers–(klubd) fingers with a short broad tip and overhanging nail, somewhat resembling a drumstick. This condition is sometimes seen in children born with certain kinds of heart defects.

coagulation–(ko-ag-u-la'shun) process of changing from a liquid to a thickened or solid state. The formation of a clot.

collateral circulation–(ko-lat'er-al ser-ku-la'shun) circulation of the blood through nearby smaller vessels when a main vessel has been blocked up.

compensation–(kom-pen-sa'shun) a change in the circulatory system made to compensate for some abnormality. An adjustment of size of heart or rate of heart beat made to counterbalance a defect in structure or function. Often used specifically to describe the maintenance of adequate circulation in spite of the presence of heart disease.

concha–(king'kah) shell-shaped structure; for example, bony projections into the nasal cavity.

congenital–(kon-jen'it-al) present at birth.

congenital anomaly–(kon-jen'i-tal ah-nom'ah-le) an abnormality present at birth.

congestive heart failure–(kon-jes'tiv) when the heart is unable to adequately pump out all the blood that returns to it, there is a backing up of blood in the veins leading to the heart. A congestion or accumulation of fluid in various parts of the body (lungs, legs, abdomen, etc.) may result from the heart's failure to maintain a satisfactory circulation.

constriction–(kon-strik'shun) narrowing, as in the phrase "vaso-constriction," which is a narrowing of the internal diameter of the blood vessels, caused by a contraction of the muscular coat of the vessels.

constrictive pericarditis–(kon-strik'tiv per'e-kar-di'tis) a shrinking and thickening of the outer sac of the heart which prevents the heart muscle from expanding and contracting normally.

contralateral–(kon'tra-lat'er-el) on the opposite side.

coronary–(kor'o-ner-i) encircling; in the form of a crown.

coronary arteries–(kor'o-ner-i) two arteries, arising from the aorta, arching down over the top of the heart, and conducting blood to the heart muscle.

coronary atherosclerosis–(kor'o-ner-i ath'er-o-skle-ro'sis) commonly called coronary heart disease. An irregular thickening of the inner layer of the walls of the arteries which conduct blood to the heart muscle. The internal channel of these arteries (the coronaries) becomes narrowed and the blood supply to the heart muscle is reduced.

coronary occlusion–(kor'o-ner-i ok-klu'zhun) an obstruction (generally a blood clot) in a branch of one of the coronary arteries which hinders the flow of blood to some part of the heart muscle. This part of the heart muscle then dies because of lack of blood supply. Sometimes called a coronary heart attack, or simply a heart attack.

cor pulmonale–(kor'pul-mo-nal'e) heart disease resulting from disease of the lungs or the blood vessels in the lungs. This is due to resistance to the passage of blood through the lungs.

corpus–(kor'pes) body.

corpuscle–(kor'pus'l) very small body or particle.

cortex–(kor'teks) outer part of an internal organ; for example, of the cerebrum and of the kidneys.

costal–(kos'tal) pertaining to the ribs.

coumarin–(koo'mah-rin) a class of chemical substances which delay clotting of the blood. An anticoagulant.

cricoid–(kri'koid) ring-shaped; a cartilage of this shape in the larynx.

cutaneous–(ku-ta'ne-us) pertaining to the skin.

cyanosis–(si-ah-no'sis) blueness of skin caused by insufficient oxygen in the blood. Oxygen is carried by hemoglobin, which is bright red when saturated with oxygen. When hemoglobin is not carrying oxygen, it is purple and is called reduced hemoglobin. The blueness of the skin occurs when the amount of reduced hemoglobin exceeds 5 grams per 100 cc. of blood.

cytology–(si-tol'o-ji) study of cells.

decompensation–(de-kom-pen-sa'shun) inability of the heart to maintain adequate circulation, usually resulting in a waterlogging of tissues. A person whose heart is failing to maintain normal circulation is said to be "decompensated."

defecation–(def-ek-a'shun) elimination of waste matter from the intestines.

defibrillator–(de-fi'bre-la-tor) any agent of measure, such as an electric shock, which stops an incoordinate contraction of the heart muscle and restores a normal heart beat.

deglutition–(deg-lu-tish'un) swallowing.

depressant–(de-pres'ant) any drug which decreases functional activity.

dermis, corium–(der'mis, kor'e-um) true skin.

dextrose–(deks'tros) glucose, a monosaccharide, the principal blood sugar.

diaphragm—(di'a-fram) membrane or partition that separates one thing from another; the muscular partition between the thorax and abdomen; the midriff.

diaphysis—(di-af'i-sis) shaft of a long bone.

diarthrosis—(di'ar-thro'sis) freely movable joint.

diastole—(di-as'to-le) in each heart beat, the period of the relaxation of the heart. Auricular diastole is the period of relaxation of the atria, or upper heart chambers. Ventricular diastole is the period of relaxation of the ventricles, or lower heart chambers.

diet—(di'et) daily allowance or intake of food and drink.

digestion—(di-jes'chun) conversion of food into assimilable compounds.

digitalis—(dig-e-tal'is) a drug prepared from leaves of foxglove plant which strengthens the contraction of the heart muscle, slows the rate of contraction of the heart, and by improving the efficiency of the heart, may promote the elimination of fluid from body tissues.

dilation—(di-la'shun) a stretching or enlargement of the heart or blood vessels beyond the norm.

diplopia—(dip-lo'pe-ah) double vision; seeing one object as two.

distal—(dis'tal) toward the end of a structure; opposite of proximal.

diuretic—(di-u-ret'ik) a medicine which promotes the excretion of urine. Several types of drugs may be used, such as mercurials, chlorothiazide, xanthine, and benzothiadiazine derivatives.

dorsal, posterior—(dor'sal, pos-te're-or) pertaining to the back, opposite of ventral.

dropsy—(drop'si) accumulation of serous fluid in a body cavity or in tissues; edema.

ductus arteriosus—(duk'tus ar-te're-o'sis) a small duct in the heart of the fetus between the artery leaving the left side of the heart (aorta) and the artery leaving the right side of the heart (pulmonary artery). Normally this duct closes soon after birth. If it does not close, the condition is known as patent or open ductus arteriosus.

dura mater—(dyoor'a ma'ter) literally strong or hard mother; outermost layer of the meninges.

dyspnea—(disp-ne'ah) difficult or labored breathing.

dystrophy—(dis-tro'fi) faulty nutrition.

ectopic—(ek-top'ik) displaced; not in the normal place; for example, extrauterine pregnancy.

edema—(e-de'mah) swelling due to abnormally large amounts of fluid in the tissues of the body.

effector—(e-fek'ter) responding organ; for example, voluntary and involuntary muscle, the heart, and glands.

electric cardiac pacemaker—(kar'de-ak pas'mak-er) an electric device that can control the beating of the heart by a rhythmic discharge of electrical impulses.

electrocardiogram—(e-lek'tro-kar'de-o-gram) often referred to as EKG or ECG. A graphic record of the electric currents produced by the heart.

electrocardiograph—(e-lek'tro-kar'de-o-graf) an instrument which records electric currents produced by the heart.

electroencephalogram—(e-lek'tro-en-cef'a-lo-gram) graphic record of brain's action potentials.

elimination—(e-lim'a-na'shen) expulsion of wastes from the body.

embolism—(em'bo-lizm) the blocking of a blood vessel by a clot or other substance carried in the blood stream.

embolus—(em'bo-lus) a blood clot (or other substance such as air, fat, tumor) inside a blood vessel which is carried in the blood stream to a smaller vessel where it becomes an obstruction to circulation.

embryo—(em'bre-o) animal in early stages of intrauterine development; the human fetus the first three months after conception.

emesis—(em'e-sis) vomiting.

emphysema—(em'fi-se'ma) dilatation of pulmonary alveoli.

empyema—(em-pi-e'mah) pus in a cavity; for example, the chest cavity.

encephalon—(en-sef'a-lon) brain.

endocarditis—(en'do-kar-di'tis) inflammation of the inner layer of the heart (endocardium) usually associated with acute rheumatic fever or some infectious agents.

endocardium—(en-do-kar'de-um) a thin smooth membrane forming the inner surface of the heart.

endocrine—(en'do-krin') secreting into the blood or tissue fluid rather than into a duct; opposite of exocrine.

endothelium—(en-do-the'le-um) the thin lining of the blood vessels.

energy—(en'er-ji) capacity for doing work.

enteron—(en'te-ron) intestine.

enzyme–(en'zim) catalytic agent formed in living cells.

epicardium–(ep-e-dar'de-um) the outer layer of the heart wall. Also called the visceral pericardium.

epidermis–(ep'e-dur'mis) "false" skin; outermost layer of the skin.

epinephrine–(ep-e-nef'rin) one of the secretions of two small glands, called adrenal glands, located just above the kidneys. This secretion, also called adrenalin, and sometimes prepared synthetically, constricts the small blood vessels (arterioles), increases the rate of heart beat, and raises blood pressure. It is called a vasoconstrictor or vasopressor substance.

essential hypertension–(hi-per-ten'shun) sometimes called primary hypertension, and commonly known as high blood pressure. An elevated blood pressure not caused by kidney or other evident disease.

eupnea–(up-ne'ah) normal respiration.

exocrine–(eks-o'krin) secreting into a duct; opposite of endocrine.

extracorporeal circulation–(eks'trah-kor-po're-al) the circulation of the blood outside the body as by a mechanical pump-oxygenator. This is often done while surgery is being performed inside the heart.

extrasystole–(eks-trah-sis'to-le) a contraction of the heart which occurs prematurely and interrupts the normal rhythm.

eyeground–(i'ground) the inside of the back part of the eye seen by looking through the pupil. Examining the eyeground is one means of assessing changes in the blood vessels. Also called the fundus of the eye.

femoral artery–(fem'or-al ar'ter-e) main blood vessel supplying blood to the leg.

fetus–(fe'tes) unborn young, especially in the later stages; in human beings, from third month of intrauterine period until birth.

fiber–(fi'ber) threadlike structure.

fibrillation–(fi'bre-la'shun) uncoordinated contractions of the heart muscle occurring when the individual muscle fibers take up independent irregular contractions.

fibrin–(fi'brin) and elastic protein which forms the essential portion of a blood clot.

fibrinogen–(fi-brin'o-jen) a soluble protein in the blood which, by the action of certain enzymes, is converted into the insoluble protein of a blood clot.

fibrinolysin–(fi-bre-nol'is-in) an enzyme which can cause coagulated blood to return to a liquid state.

fibrinolytic–(fi'brin-o-lit'ik) having the ability to dissolve a blood clot.

flaccid–(flak'sid) soft, limp.

fluoroscope–(floo-o'ro-skop) an instrument for observing structures deep inside the body. X-rays are passed through the body onto a fluorescent screen where the shadow of deep lying organs can be seen.

folicle–(fol'i-k'l) small sac or gland.

fontanelle–(fon'te-nel') "soft spots" of the infant's head; unossified areas in the infant skull.

foramen ovale–(fo-ra'men o-va'le) an oval hole between the left and right upper chambers of the heart which normally closes shortly after birth. Its failure to close is one of the congenital defects of the heart, called a patent foramen ovale.

fundus–(fun'des) base of a hollow organ; for example, the part farthest from its outlet.

fundus of the eye–(fun'des) the inside of the back part of the eye seen by looking through the pupil. Examining the fundus of the eye is used as a means of assessing changes in the blood vessels. Also called the eyeground.

gallop rhythm–an extra, clearly heard heart sound which, when the heart rate is fast, resembles a horse's gallop. It may or may not be significant.

ganglion–(gang'gle-on) a mass of nerve cells, which serves as a center of nervous influence.

ganglionic blocking agents–(gang-gle-on'ik) a drug that blocks the transmission of a nerve impulse at the nerve centers (ganglia). Some of these drugs, such as hexamethonium and mecamylamine hydrochloride, may be used in the treatment of high blood pressure.

gastric–(gas'trik) pertaining to the stomach.

genetics–(je-net'iks) the study of heredity.

genitals–(jen'a-t'ls) reproductive organs; genitalia.

gestation–(jes-ta'shen) pregnancy.

gland–(gland) secreting structure.

glucose–(gloo'kos) monosaccharide or simple sugar; the principal blood sugar.

gluteal–(gloo-te'el) of or near the buttocks.

gonad–(gon'ad) sex gland in which reproductive cells are formed.

heart block–interference with the conduction of the electrical impulses of the heart which can be either partial or complete. This can result in dissociation of the rhythms of the upper and lower heart chambers.

heart-lung machine—a machine through which the blood stream is diverted for pumping and oxygenation while the heart is opened for surgery.

hemiplegia—(hem-e-ple'je-ah) paralysis of one side of the body caused by damage to the opposite side of the brain. The paralyzed arm and leg are opposite to the side of the brain damage because the nerves cross in the brain, and one side of the brain controls the opposite side of the body. Such paralysis is sometimes caused by a blood clot or hemorrhage in a blood vessel in the brain.

hemoglobin—(he-mo-glo'bin) the oxygen-carrying red pigment of the red blood corpuscles. When it has absorbed oxygen in the lungs, it is bright red and called oxyhemoglobin. After it has given up its oxygen load in the tissues, it is purple in color, and is called reduced hemoglobin.

hemolysis—(he-mol'i-sis) destruction of red blood cells with escape of hemoglobin from them into surrounding medium.

hemorrhage—(hem'or-ij) loss of blood from a blood vessel. In external hemorrhage blood escapes from the body. In internal hemorrhage blood passes into tissues surrounding the ruptured blood vessel.

hepar—(he'par) liver.

heparin—(hep'ah-rin) a chemical substance which tends to prevent blood from clotting. Sometimes used in cases of an existing clot in an artery or vein to prevent enlargement of the clot or the formation of new clots. An anticoagulant.

heredity—(he-red'a-ti) transmission of characteristics from a parent to a child.

hernia, "rupture"—(hur'ni-a, "rup'cher") protrusion of a loop of an organ through an abnormal opening.

hexamethonium chloride—(hek-sah-meth-own'e-um klo'ride) a drug which lowers blood pressure and increases blood flow by interfering with the transmission of nerve impulses which constrict the blood vessels. One of the ganglionic blocking agents, it is one of the drugs used in the treatment of high blood pressure.

hormone—(hor'mon) substance secreted by an endocrine gland.

hydralazine hydrochloride—(hi-drahl'a-zin hi-dro-klor'ride) a drug which lowers blood pressure. One of the anti-hypertensive agents.

hymen—(hi'men) Greek for skin; mucous membrane that may partially or entirely occlude the vaginal outlet.

hyoid—(hi'oid) U-shaped; bone of this shape at the base of the tongue.

hyperemia—(hi'per-e'mi-a) increased blood in a part.

hyperopia—(hi-per-o'pe-a) farsightedness.

hyperpnea—(hi'perp-ne'a) abnormally rapid breathing; panting.

hypertension—(hi-per-ten'shun) commonly called high blood pressure. An unstable or persistent elevation of blood pressure above the normal range, which may eventually lead to increased heart size and kidney damage.

hyperthermia—(hi'per-ther'mi-a) fever; body temperture above 37°C.

hyperthyroidism—(hi-per-thi'roid-izm) a condition in which the thyroid gland is overly active. This may eventually result in a speeded up rate of heart beat.

hypotension—(hi-po-ten'shun) commonly called low blood pressure. Blood pressure below the normal range. Most commonly used to describe an acute fall in blood pressure, as occurs in shock.

hypothalamus—(hi-po-thal'ah-mus) a part of the brain which exerts control over activity of the abdominal organs, water balance, temperature, etc. Damage to the hypothalamus may cause abnormal gain in weight, among other things.

hypothermia—(hi-po-ther'me-ah) also called hypothermy. The lowering of the body temperature (usually to 86°-88°F.) in order to slow the metabolic processes during heart surgery. In this cooled state, body tissues require less oxygen.

hypothyroidism—(hi-po-thi'roid-izm) a condition in which the thyroid gland is underactive, resulting in the slowing down of many of the body processes including the heart rate.

hypoxia—(hi-pok'se-ah) less than normal content of oxygen in the organs and tissues of the body. At very high altitudes a healthy person suffers from hypoxia because of insufficient oxygen in the air that is breathed.

iliac artery—(il'e-ak ar'ter-e) a large artery which conducts blood to the pelvis and the legs.

infarct—(in'farkt) an area of a tissue which is damaged or dies as a result of not receiving a sufficient blood supply. Frequently used in the phrase "myocardial infarct" referring to an area of the heart muscle damaged or killed by an insufficient flow of blood through the coronary arteries which normally supply it.

inferior—(in-fer'i-er) lower; opposite of superior.

inhalation—(in'ha-la'shen) inspiration or breathing in; opposite of exhalation or expiration.

inhibition—(in'hi-bish'en) checking or restraining of action.

insufficiency—(in-suh-fish'en-se) incompetency. In the term "valvular insufficiency" an improper closing of the valves which admits a back flow of blood in the wrong direction. In the term "myocardial insufficiency," inability of the heart muscle to do a normal pumping job.

insulin—(in'sa-lin) hormone secreted by islands of Langerhans in the pancreas.

intima—(in'te-mah) the innermost layer of a blood vessel.

involuntary—(in-vol'en-ter'i) not willed; opposite of voluntary.

ischemia—(is-ke'me-ah) a local, usually temporary, deficiency of blood in some part of the body, often caused by a constriction or an obstruction in the blood vessel supplying that part.

jugular veins—(jug'u-lar) veins which return blood from the head and neck to the heart.

kilogram—(kil'a-gram) 1,000 grams; approximately 2.2 pounds.

labia—(la'bi-a) lips.

lateral—(lat'er-el) of or toward the side; opposite of medial.

leukocyte—(loo'ke-sit') white blood cell.

ligament—(lig'a-ment) bond or band connecting two objects; in anatomy a band of white fibrous tissue connecting bones.

linoleic acid—(lin-o-lay'ik) an important component of many of the unsaturated fats. It is found widely in oils from plants. A diet with a high linoleic acid content tends to lower the amount of cholesterol in the blood.

lipid—(li'pid) fat.

loin—(loin) part of the back between the ribs and hip bones.

lumbar—(lum'ber) of or near the loins.

lumen—(lu'men) the passageway inside a tubular organ. Vascular lumen is the passageway inside a blood vessel.

lymph—(limf) watery fluid in the lymphatic vessels.

lymphocyte—(lim'fe-sit') one type of white blood cells.

malignant hypertension—(mah-lig'nant hi-per-ten'-shun)severe high blood pressure that runs a rapid course and causes damage to the blood vessel walls in the kidney, eye, etc.

monometer—(ma-nom'e-ter) instrument used for measuring the pressure of fluids.

medial—(me'di-el) of or toward the middle; opposite of lateral.

mediastinum—(me'di-as-ti'nem) middle section of the thorax; that is, between the two lungs.

membrane—(mem'bran) thin layer or sheet.

menstruation—(men'stroo-a'shen) monthly discharge of blood from the uterus.

mesentery—(mes'n-ter'i) fold of peritoneum that attaches the intestine to the posterior abdominal wall.

metabolism—(me-tab'o-lizm) complex process by which food is utilized by a living organism.

metacarpus—(met'e-kar'pes) "after" the wrist; hence, the part of the hand between the wrist and fingers.

metatarsus—(met'e-tar'ses) "after" the instep; hence, the part of the foot between the tarsal bones and the toes.

meter—(me'ter) about 39.5 inches.

millimeter—(mil'li-me-ter) 1/1,000 meter; about 1/25 inch.

mitral—(mi'tral) shaped like a miter.

mitral insufficiency—(mi'tral) an improper closing of the mitral valve between the upper and lower chamber in the left side of the heart which admits a back flow of blood in the wrong direction. Sometimes the result of scar tissue forming after a rheumatic fever infection.

mitral valve—(mi'tral) sometimes called bicuspid valve. A valve of two cusps or triangular segments, located between the upper and lower chamber in the left side of the heart.

murmur—(mur'mur) an abnormal heart sound, sounding like fluid passing an obstruction, heard between the normal lub-dub heart sounds.

myocardial infarction—(mi-o-kar'de-al in-fark'shun) the damaging or death of an area of the heart muscle (myocardium) resulting from a reduction in the blood supply reaching that area.

myocardial insufficiency—(mi-o-kar'de-al) an inability of the heart muscle (myocardium) to maintain normal circulation.

myocarditis—(my'o-kar-di'tis) inflammation of the heart muscle (myocardium).

myocardium—(mi-o-kar'de-um) the muscular wall of the heart. The thickest of the three layers of the heart wall, it lies between the inner layer (endocardium) and the outer layer (epicardium).

myopia—(mi-o'pi-a) nearsightedness.

nares—(nar'ez) nostrils.

neurogenic—(nu-ro-jen'ik) originating in the nervous system.

neurosis—(nu-ro'sis) a functional nervous disease in which the personality remains more or less intact.

nitrites—(ni'trits) a group of chemical compounds, many of which cause dilation of the small blood vessels, and thus lower blood pressure. They are vasodilators. Examples are amyl nitrite, sodium nitrite, etc.

nitroglycerin—(ni-tro-glis'er-in) a drug (one of the nitrates) which relaxes the muscles in the blood vessels. Often used to relieve attacks of angina pectoris and spasm of coronary arteries. It is one of the vasodilators.

noradrenalin—(nor-ad-ren'ah-lin) an organic compound which produces a rise in blood pressure by constricting the small blood vessels. Sometimes used in the treatment of shock. Also called norepinephrine and levarterenol.

norepinephrine—(nor'ep-e-nef'rin) an organic compound which produces a rise in blood pressure by constricting the small blood vessels. Sometimes used in the treatment of shock. Also called noradrenalin and levarterenol.

nutrition—(nu-trish'un) the combination of processes by which a living organism receives and utilizes the materials necessary for the maintenance of its functions and for the growth and renewal of its components.

open heart surgery—surgery performed on the opened heart while the blood stream is diverted through a heart-lung machine. This machine pumps and oxygenates the blood in lieu of the action of the heart and lungs during the operation.

organic heart disease—heart disease by some structural abnormality in the heart or circulatory system.

os—(os) Latin for mouth and for bone.

otitis media—(o-ti'tis me'de-ah) an infection of the middle ear, frequently caused by a spreading of a bacterial infection of the throat.

pacemaker—(pas'mak-er) a small mass of specialized cells in the right upper chamber of the heart which give rise to the electrical impulses that initiate contractions of the heart. Also called sino-atrial node or S-A node of Keith-Flack. The term "pacemaker," or more exactly, "electric cardiac pacemaker," or "electrical pacemaker" is applied to an electrical device which can substitute for a defective natural pacemaker and control the beating of the heart by a series of rhythmic electrical discharges. If the electrodes which deliver the discharges to the heart are placed on the outside of the chest, it is called an "external pacemaker." If the electrodes are placed within the chest wall, it is called an "internal pacemaker."

palate—(pal'it) roof of the mouth.

palpitation—(pal-pi-ta'shun) a fluttering of the heart or abnormal rate or rhythm of the heart experienced by the person himself.

paralysis—(pe-ral'e-sis) loss of the power of motion of sensation, especially loss of voluntary motion.

paraplegia—(par-ah-ple'je-ah) loss of both motion and sensation in the legs and lower part of the body. This most commonly is due to damage to the spinal cord, but sometimes results from a blood clot or hemorrhage in an artery conducting blood to the spinal cord.

parasympathetic nervous system—(par'ah-sim-pah-thet'ik) a part of the autonomic or involuntary nervous system. Stimulation of various parasympathetic nerves causes the pupils of the eyes to contract, the heart to beat more slowly, and produces other nonvoluntary reactions.

patella—(pa-tel'a) small, shallow pan; the kneecap.

pathology—(pah-thol'o-je) the study of the essential nature of disease and the structural and functional changes it causes.

pelvis—(pel'vis) basin or funnel-shaped structure.

percussion—(per-kush'un) tapping the body as an aid in diagnosing the condition of parts beneath by the sound obtained, much as one taps on a barrel to detect its fullness.

pericarditis—(per'e-kar-di'tis) inflammation of the thin membrane sac (pericardium) which surrounds the heart.

pericardium—(per-e-kar'de-um) a thin membrane sac which surrounds the heart and roots of the great vessels.

peripheral—(pa-rif'er-el) pertaining to an outside surface.

phalanges—(fe-lan'jez) finger or toe bones.

pharmacology—(fahr-mah-kol'o-je) the science which deals with the study of drugs in all its aspects.

phlebitis—(fle-bit'tis) inflammation of a vein, often in the leg. Sometimes a blood clot is formed in the inflamed vein.

phrenic—(fren'ik) pertaining to the diaphragm.

physical therapy—(ther'ah-pe) the treatment of disease by physical means. Includes the use of heat, cold, water, light, electricity, manipulation, massage, exercise, and mechanical devices. Also called physiotherapy.

pia mater—(pi'a ma'ter) gentle mother; the vascular innermost covering (meninges) of the brain and cord.

plasma—(plaz'mah) the cell-free liquid portion of uncoagulated blood. It is different from serum which is the fluid portion of the blood obtained after coagulation.

polygraph—(pol'e-graf) an instrument for taking synchronous records of several different pulsations.

pons—(ponz) bridge.

popliteal—(pop-lit'i-el) behind the knee.

posterior—(pos-ter'i-er) following after; hence, located behind; opposite of anterior.

pressor—(pres'or) a substance which raises the blood pressure and accelerates the heart beat. Also denotes certain nerve fibers which produce a rise in blood pressure when stimulated.

primary hypertension—(hi-per-ten'shun) sometimes called essential hypertension, and commonly known as high blood pressure. An elevated blood pressure not caused by kidney or other evident disease.

procaine amide—(pro'kan am'id) a drug sometimes used to treat abnormal rhythms of the heart beat.

prophylaxis—(pro'fi-lak'sis) preventive treatment.

proximal—(prok'sa-m'l) next or nearest; located nearest the center of the body of the point of attachment of a structure.

psychosis—(si-ko'sis) a severe, specific mental disorder that has a characteristic origin, course, and symptoms.

psychosomatic—(si'ko-so-mat'ik) pertaining to the influence of the mind, emotions, fears, etc., upon the functions of the body, especially in relation to disease.

psychotherapy—(si-ko-ther'ah-pe) the treatment of disorders by the use of such means as persuasion, suggestion, educational techniques, lay or religious counseling, or psychoanalysis.

puberty—(pu'ber-ti) age at which the reproductive organs become functional.

pulmonary artery—(pul'mo-na-re) the large artery which conveys unoxygenated (venour) blood from the lower right chamber of the heart to the lungs. This is the only artery in the body which carries unoxygenated blood, all others carry oxygenated blood to the body.

pulmonary circulation—(pul'mo-na-re) the circulation of the blood through the lungs, the flow being from the right lower chamber of the heart (right ventricle) through the lungs, back to the left upper chamber of the heart (left atrium).

pulmonary valve—(pul'mo-na-re) valve, formed by three cup-shaped membranes at the junction of the pulmonary artery and the right lower chamber of the heart (right ventricle). When the right lower chamber contracts, the pulmonary valve opens and the blood is forced into the artery leading to the lungs. When the chamber relaxes, the valve is closed and prevents a back-flow of the blood.

pulmonary veins—(pul'mo-na-re) four veins (two from each lung) which conduct oxygenated blood from the lungs into the left upper chamber of the heart (left atrium).

pulse—(puls) the expansion and contraction of an artery which may be felt with the finger.

pulse pressure—(puls) the difference between the blood pressure in the arteries when the heart is in contraction (systole) and when it is in relaxation (diastole).

quinidine—(kwin'i-deen) a drug sometimes used to treat abnormal rhythms of the heart beat.

reflex—(re'fleks) involuntary action.

regurgitation—(re-gur-ji-ta'shun) the backward flow of blood through a defective valve.

rehabilitation—(re-hah-bil-i-ta'shun) the return of a person disabled by accident or disease to the maximum attainable physical, mental, emotional, social and economic usefulness, and, if employable, an opportunity for gainful employment.

renal—(re'nal) pertaining to the kidney.

renal circulation—(re'nal) the circulation of the blood through the kidneys. Important in heart disease because of its function in the elimination of water, certain chemical elements, and waste products from the body.

renal hypertension—(re'nal hi-per-ten'shun) high blood pressure caused by damage to or disease of the kidneys.

rheumatic fever—(ru-mat'ik) a disease, usually occurring in childhood, which may follow a few weeks after a streptococcal infection. It is sometimes characterized by one or more of the following: fever, sore swollen joints, a skin rash, occasionally by involuntary twitching of the muscles (called St. Vitus Dance) and small nodes under the skin. In some cases the infection affects the heart and may result in scarring the valves, weakening the heart muscle, or damaging the sac enclosing the heart.

rheumatic heart disease—(ru-mat'ik) the damage done to the heart, particularly the heart valves, by one or more attacks of rheumatic fever. The valves are sometimes scarred so they do not open and close normally.

rugae—(roo'je) wrinkles or folds.

S-A node—(nod) a small mass of specialized cells in the right upper chamber of the heart which gives rise to the electrical impulses that initiate contractions of the heart. Also called sino-atrial node or pacemaker.

sciatic—(si-at'ik) pertaining to the ischium.

sclerosis—(skle-ro'sis) hardening, usually due to an accumulation of fibrous tissue.

secondary hypertension—(hi-per-ten'shun) an elevated blood pressure caused by (i.e., secondary to) certain specific diseases or infections.

sedative—(sed'ah-tiv) a drug which depresses the activity of the central nervous system, thus having a calming effect. Examples are barbiturates, chloral hydrate, and bromides.

semen—(se'men) Latin for seed: male reproductive fluid.

septum—(sep'tum) a dividing wall.

1. Atrial or inter-atrial septum. Muscular wall dividing left and right upper chambers (called atria) of the heart.

2. Ventricular or inter-ventricular septum. Muscular wall, thinner at the top, dividing the left and right lower chambers (called ventricles) of the heart.

serum—(se'rum) the fluid portion of blood which remains after the cellular elements have been removed by coagulation. It is different from plasma which is the cell-free liquid portion of uncoagulated blood.

sign—any objective evidence of a disease. "What you see."

sino-atrial node—(si-no-a'tre-al) a small mass of specialized cells in the right upper chamber of the heart which give rise to the electrical impulses that initiate contractions of the heart. Also called S-A node or pacemaker.

sodium—(so'de-um) a mineral essential to life, found in nearly all plant and animal tissue. Table salt (sodium chloride) is nearly half sodium. In some types of heart disease the body retains an excess of sodium and water, and therefore sodium intake is restricted.

sphygmomanometer—(sfig'mo-mah-nom'e-ter) an instrument for measuring blood pressure in the arteries.

stethoscope—(steth'o-skop) an instrument for listening to sounds within the body.

stimulus—(stim'yoo-les) agent that causes a change in the activity of a structure.

Stokes-Adams syndrome—(sin'drom) sudden attacks of unconsciousness, sometimes with convulsions, which may accompany heart block.

stress—(stres) according to Selye, physiological stress is a condition in the body produced by all kinds of injurious factors that he calls "stressors" and manifested by a syndrome (a group of symptoms that occur together).

stressor—(stres'or) any injurious factor that produces biological stress; for example, emotional trauma, infections, severe exercise.

striated—(stri'at-id) marked with parallel lines.

stroke—(strok) also called apoplectic stroke, cerebrovascular accident, or cerebral vascular accident. An impeded blood supply to some part of the brain, generally caused by:

1. a blood clot forming in the vessel (cerebral thrombosis).

2. a rupture of the blood vessel wall (cerebral hemorrhage).

3. a piece of clot or other material from another part of the vascular system which flows to the brain and obstructs a cerebral vessel (cerebral embolism).

4. pressure on a blood vessel, as by a tumor.

stroke volume—(strok) the amount of blood which is pumped out of the heart at each contraction of the heart.

superior—(se-per'i-er) higher; opposite of inferior.

sympathetic nervous system—(sim-pah-thet'ik) a part of the autonomic nervous system or involuntary nervous system, it regulates tissues not under voluntary control, e.g., glands, heart, and smooth muscle.

symptom–(simp'tum) any subjective evidence of a patient's condition. "What the victim tells you."

syncope–(sin'ko-pe) a faint. One cause for syncope can be an insufficient blood supply to the brain.

syndrome–(sin'drom) a set of symptoms which occur together and are therefore given a name to indicate that particular combination.

systemic circulation–(sis-tem'ik) the circulation of the blood through all parts of the body except the lungs, the flow being from the left lower chamber of the heart (left ventricle) through the body, back to the right upper chamber of the heart (right atrium).

systole–(sis'to-le) in each heart beat, the period of contraction of the heart. Atrial systole is the period of the contraction of the upper chambers of the heart, called the atria. Ventricular systole is the period of the contraction of the lower chambers of the heart, called the ventricles.

tachycardia–(tak-e-kar'de-ah) abnormally fast heart rate. Generally, anything over 100 beats per minute is considered a tachycardia.

tarsus–(tar'ses) instep.

tendon–(ten'den) band or cord of fibrous connective tissue which attaches a muscle to a bone or other structure.

therapist–(ther'ah-pist) a person skilled in the treatment of disease.

thorax–(tho'raks) chest.

thrombectomy–(throm-bek'to-me) an operation to remove a blood clot from a blood vessel.

thrombolytic agents–(throm-bo-lit'ik) substances which dissolve blood clots.

thrombophlebitis–(throm'bo-fle-bi'tis) inflammation and blood clotting in a vein.

thrombosis–(throm-bo'sis) the formation or presence of a blood clot (thrombus) inside a blood vessel or cavity of the heart.

thrombus–(throm'bus) a blood clot which forms inside a blood vessel or cavity of the heart.

thyrotoxic–(thi-ro-tak'sik) pertaining to overactivity or abnormal activity of the thyroid gland.

tibia–(tib'i-a) Latin for shin bone.

toxemia–(toks-e'me-ah) the condition caused by poisonous substances in the blood.

toxic–(tok'sik) pertaining to poison.

trauma–(trau'ma) injury.

tricuspid valve–(tri-kus'pid) a valve consisting of three cusps or triangular segments located between the upper and lower chamber in the right side of the heart. Its position corresponds to the bicuspid or mitral valve in the left side of the heart.

umbilicus–(um-bil'i-kes) navel.

uremia–(u-re'me-ah) an excess in the blood of certain waste substances normally excreted by the kidneys.

vagina–(va-ji'na) sheath.

vagus nerves–(va'gus) two of the nerves of the parasympathetic nervous system which extend from the brain, through the neck and thorax into the abdomen. Known as the inhibitory nerves of the heart, they slow the heart rate when stimulated.

valve–(valv) structure which permits flow of a fluid in one direction only.

valvular insufficiency–(val'vu-lar) valves which close improperly and admit a back flow of blood in the wrong direction.

vasoconstrictor–(vas'o-kon-strik'tor) the vasoconstrictor nerves are one part of the involuntary nervous system. When these nerves are stimulated they cause the muscles of the arterioles to contract, thus narrowing the arteriole passage, increasing the resistance to the flow of blood, and raising the blood pressure. Chemical substances which stimulate the muscles of the arterioles to contract are called vasoconstrictor agents or vasopressors. An example is adrenalin or epinephrine.

vasodilator–(vas'o-di-lat'or) vasodilator nerves are certain nerve fibers of the involuntary nervous system which cause the muscles of the arterioles to relax, thus enlarging the arteriole passage, reducing resistance to the flow of blood, and lowering blood pressure. Vasodilator agents are chemical compounds which cause a relaxation of the muscles of the arterioles. Examples of this type of drug are nitroglycerine, nitrates, thiocyanate, and many others.

vaso-inhibitor–(vas'o-in-hib'i-tor) an agent or drug which inhibits the action of the vasomotor nerves. When these involuntary nerves are inhibited, the muscles of the arterioles relax, and the passage inside the arteriole is enlarged, and the blood pressure is lowered. Examples of this type of drug are compounds of nitrite.

vasopressor–(vas-o-pres'or) a chemical substance which causes the muscles of the arterioles to contract, narrowing the arteriole passage, and thus raises the blood pressure. Such substances are also called vasoconstrictors. An example is adrenalin or epinephrine.

vein–(vain) any one of a series of vessels of the vascular system which carries blood from various parts of the body back to the heart. All veins in the body conduct unoxygenated blood except the pulmonary veins which conduct freshly oxygenated blood from the lungs back to the heart.

vena cava–(ve'nah ka'vah) superior vena cava is a large vein conducting blood from the upper part of the body (head, neck, and thorax) to the right upper chamber of the heart. Inferior vena cava is a large vein conducting blood from the lower part of the body to the right upper chamber of the heart.

venous blood–(ve'nus) unoxygenated blood. The blood, with hemoglobin in the reduced state, is carried by the veins from all parts of the body back to the heart and then pumped by the right side of the heart to the lungs where it is oxygenated.

ventral–(ven'trel) of or near the belly; in man, front or anterior; opposite of dorsal or posterior.

ventricle–(ven'tre-kl) one of the two lower chambers of the heart. Left ventricle pumps oxygenated blood through arteries to the body. Right ventricle pumps unoxygenated blood through pulmonary artery to lungs. Capacity about 85 cc.

ventricular septum–(ven-trik'u-lar sep'tum) sometimes called inter-ventricular septum. Muscular wall, thinner at the top, dividing the left and right lower chambers of the heart which are called ventricles.

venule–(ven'ul) a very small vein.

veratrum–(ve-ra'trum) a drug which lowers blood pressure and decreases the heart rate. One of the anti-hypertensive agents.

vermiform–(vur'me-form') worm-shaped.

viscera–(vis'er-a) internal organs.

xanthine–(zan'thin) a class of drugs used to increase the excretion of urine. A diuretic.

xiphoid–(zif'oid) sword-shaped.

BIBLIOGRAPHY

"First Aid and Emergency Procedures," United States Navy, Handbook of the Hospital Corps, Chapter III.

"First Aid," A Bureau of Mines Instruction Manual. United States Department of the Interior, U.S. Government Printing Office, Washington, D.C.

"Medical Requirements for Ambulance Design and Equipment." National Academy of Sciences, National Research Council, Washington, D.C.

"Structure and Function of the Body." Catherine Parker Anthony, R.N., B.A., M.S., The C.V. Mosby Company, St. Louis, Missouri.

"Essential Equipment for Ambulances," Bulletin, American College of Surgeons, May, 1970.